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ABSTRACT

This study was conducted as part of Project PRIME (Planning Resources in Minnesota Education), which is a 1-year project to test implement the CAMPUS simulation model in 3 institutions of higher education in Minnesota. The purpose of this study was to explore a self-sampling method of collecting data on faculty to determine if there were any significant differences between the data collected via sampling and the data collected via estimating. Another purpose of the study was to assess the feasibility of using self-sampling as a method of collecting data. A secondary objective was to develop parameters for Project PRIME. Chapter I deals with the problems facing higher education, the need for planning, planning models and systems, and the role of faculty activity analysis in planning models and systems. Chapter II is a review of the literature relating to faculty activity analysis in the past and is broken down in 3 major categories: (1) defining faculty activities; (2) faculty activity measurement and data collection; and (3) uses of faculty data. Chapter III explains the experiment done as part of this research and describes the population, the self-sampling method, and the category definitions used. Chapter IV summarizes the results of the experiment described in Chapter III; and Chapter V summarizes the study and discusses implications for further research. (AF)

Project PRIME Report No. 6

FACULTY ACTIVITY ANALYSIS AND PLANNING MODELS IN HIGHER EDUCATION

Alden C. Lorents, Ph.D., CDP

June 1971

Project PRIME Research Coordinated by the
Minnesota Higher Education Coordinating Commission

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A.C.L.

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INTRODUCTION

TRENDS AND ECONOMIC PRESSURES IN HIGHER EDUCATION

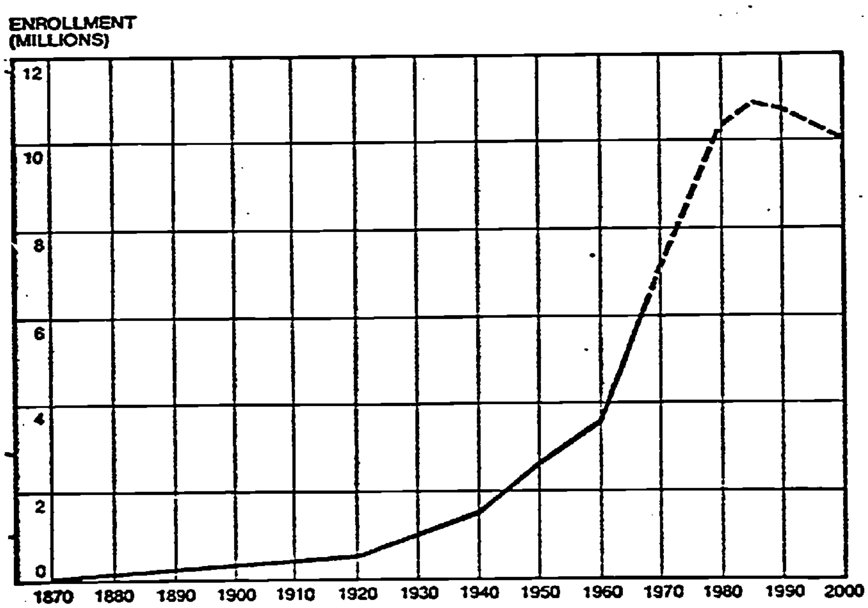
Higher education is presently faced with a multitude of problems in the wake of increasing pressures from taxpayers, legislatures, faculty, students, and parents. The problems have come about through dynamic student growth rates, rising costs, program expansion, increasing complexity of the systems, and a growing dissatisfaction with the outputs.

DYNAMIC STUDENT GROWTH RATES

"A century ago, two percent of young Americans entered college. Now the figure is over forty percent and is still rising." [Carnegie Commission on Higher Education, 1968]. In 1870 there were only about 50,000 students enrolled in colleges. The growth from this period is demonstrated in Figure 1.1.

FIGURE 1.1

Enrollment In Institutions Of Higher Eduction



[Carnegie Commission on Higher Education, 1968: 4]

In 1940 there were about 1.5 million students. By 1960 this has risen to about 3.5 million, an increase of 133 percent over a 20 year period. By 1980 the enrollment is estimated to climb to 10.3 million, an increase of 194 percent over this 20 year period. These growth rates are a reflection of three growth factors (1) Growing population, (2) An increase in the percentage of college age population, and (3) The growing percentage of college age students going to college.

Enrollments in Minnesota higher education have gone from about 56 thousand in 1960 to about 140 thousand in 1970, an increase of 115 percent. Projections indicate that Minnesota enrollments in higher education will climb to 169 thousand by 1980 and then drop back to about 140 thousand again in 1985 [Minnesota Higher Education Coordinating Commission, 1968: 13]

RISING COSTS

Higher education costs per student are rising rapidly. The Carnegie Commission Report in 1968 reported an increase in institutional expenditures for higher education from 5.2 billion in 1957-58 to about 17.2 billion in 1967-68, an increase of 231 percent. This is compared with a 119 percent increase in enrollments over the same period. The report estimates that about $41 billion will be spent by institutions of higher education by 1976-77 for the projected FTE* enrollment of 9 million students [Carnegie Commission on Higher Education 1968: 6].

*FTE = Full Time Equivalent.

These costs do not include a lot of the additional costs by the students that are not channeled through the institution. The impact of the rising costs can be seen better when one compares the costs of education to the Gross National Product (GNP) and the Consumer Price Index. In 1957 the expenditures by higher education were about 1 percent of the $432 billion GNP. By 1967 it was just over 2 percent of the 763 billion GNP. By 1976 it is projected to be about 3 percent of the 1,400 billion GNP [Carnegie Commission on Higher Education, 1968: 6]. Figure 1.2 shows expenditures per student as they compare to the consumer price index. The cost per student index rose 55 points during the ten year period from 1955 to 1965, while the consumer price index rose less than 20 points.

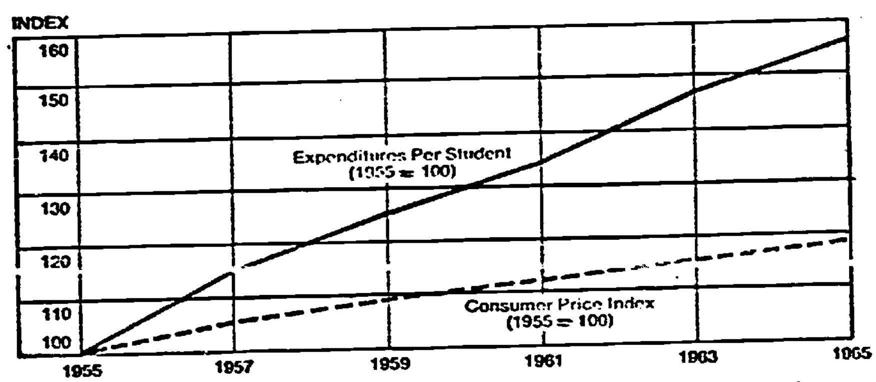
The impact of the situation is demonstrated by the following titles and sub headings in recent articles: "Total Cost of Higher Education Continues to Rise", "Less Money is Available to Higher Education", "Cost Cutting is Vigorous on Many Campuses", "Educations Big Bill in the 70's" [See College Management, January issues, 1970 and 1971].

PROGRAM EXPANSION

"Colleges and Universities in the United State have grown steadily in the number and complexity of functions they have assumed in response to both the expansion of knowledge and the needs of society. These expanding functions have brought our institutions of higher education to a central role in the well-being of our society" [Carnegie Commission on Higher Education 1968: 5].

FIGURE 1.2

Compararative Rise of Direct Educational Expenditures Per Student and Consumer Price Index



[Carnegie Commission on Higher Education, 1968: 7]

Specialized programs of some type have been implemented in many institutions across the nation. These programs are expensive because of the start up costs and the low number of students in the programs. Many states are attempting to control the proliferation of new programs through their coordinating bodies, so that there will not be excessive duplication. Many of the new programs are in the graduate area where the costs per student are already very high. As institutions spread their resources over greater numbers of courses and programs, they lose economies of scale and costs rise.

COMPLEX SYSTEMS

Institutions of higher education have become complex organizations. The growth, multiplicity of programs, and the large number of interfaces between sub-units have contributed to this complexity. Adding to this complexity is the management process in higher education. An attempt is made to direct the institution via a committee process. In the past the pressure to be involved in the decision making process was just by the faculty. Now, representation is being increased by the addition of students.

Administrators in higher education generally have not been trained in administration, so their training becomes largely a heuristic process. Often times administrators at the department and division levels do not want to make the transition to being managers, because they feel then they are no longer faculty.

Lawrence, Minter and Caffrey state in their introduction to

Management Information Systems: Their Development and Use in the Administration of Higher Education that

> A number of factors suggest that institutions of higher education are becoming more difficult to manage. Some of these factors are the increasing size and complexity of institutions, public concerns over rising costs, student disenchantment with the relevancy of "educational" activities and an acknowledgement by administrators of increasing uncertainty in the decision making process [Minter and Lawrence, 1969: VII].

Another WICHE* seminar report emphasized the compound problem of being called to accountability and the difficulty of financing Higher Education.

> Both internally and externally the university is being called to accountability. To the problem of accountability add the difficult problem of financing higher education. Spiraling costs, increased enrollments, and tight money compound the fiscal crisis which confronts university decision makers. Money spent to hire more teachers is not available to improve the salary of existing faculty. Money spent to beef up the engineering program is not available to improve curriculum offerings in the fine arts. Money spent to equip offices of added personnel is not available to buy bookcases and files in existing staff quarters [Lawrence, Weathersby, and Patterson, 1970: 1].

DISSATISFACTION WITH THE OUTPUTS

Student unrest across the nation has caused dissatisfaction among parents, legislators and citizens with what is happening on the campuses. In many cases it is difficult to attribute the problem directly to the campus. Sometimes the campus is used as a vehicle by which the students can demonstrate their feelings about various world situations. Regardless of the

*Western Interstate Commission on Higher Education, Boulder, Colorado.

cause, these protests and demonstrations have hurt both the private and public support of higher education. This has affected the larger state supported institutions and many of the private institutions the most. The smaller state supported institutions have not been faced with as many problems, and consequently they have not received as much adverse publicity.

More and more taxpayers and lawmakers are becoming concerned with measuring the outputs of education. The emphasis on the problem of measuring outputs in education has been brought about partially by the emphasis on program, planning and budgeting systems in higher education. The state of the art in measuring outputs in education is still very embryonic. WICHE has held a seminar focusing on the topic, but all discussions are still very conceptual and not operational. Astin summed up his paper with the following conclusions.

> 1. Student outputs can be understood if they are viewed in relation to the total higher educational system. Specifically, student outputs should be considered as part of a three-component model comprising student outputs, student inputs, and characteristics of the college environment. Educational planning requires a knowledge of how outputs are affected by environmental variables. Such effects however, cannot be determined without information on student inputs.
>
> 2. Because of great variations in the values and objectives of different persons, any attempt to develop a single "overall" student output measure is unrealistic. Rather, the investigator must seek to develop a battery of measures that is sufficiently broad to satisfy the major concerns of a substantial number of students, educators, and planners. In addition, provision should be made to include measures of possible "side effects."
>
> 3. A preliminary taxonomy of student-output

measures would include the following three dimensions: the type of outcome (cognitive versus affective), the type of data (psychological versus sociological), and the temporal aspects of the measure (short-term versus long-term). This taxonomic scheme should prove useful, both for classifying existing measures and for identifying gaps where additional measures are needed.

4. Although relative or derived measures are widely used in educational research, particularly in the measurement of cognitive outputs, such measures present serious conceptual problems which limit their value for modeling and planning. Whenever possible, the investigator should strive to develop absolute rather than relative measures of student outputs.

5. The use of output measures--whether relative or absolute--in educational modeling and planning requires that the desired population changes, in the distribution of scores on each measure, be specified. In planning such changes, the investigator must consider changes in the <u>shape</u> of the performance distribution as well as changes in the mean and variance [Lawrence, Weathersby, and Patterson, 1970: 83].

THE NEED FOR PLANNING IN HIGHER EDUCATION

The problems cited in the first section of this chapter have been a catalyst to begin a flurry of activity to develop planning systems in higher education. The rapid growth of the institutions have created complex decision making situations. Presidents are no longer controlling the university alone. They must decentralize decision making and develop systems to monitor the process so that the overall goals of the institution are reached. They need systems that can provide information on alternatives since now, more than ever before, they are faced with having to make decisions on alternatives. It is not just a matter of trying to control the telephone bill, or to try and hold down supplies cost. It is in what programs should enrollments be restricted, or what programs should be dropped? At the present time, most institutions have a difficult time determining costs of their output. Rough estimates are made based upon number of degrees awarded and total expenditures. Information of this nature is not very helpful for decision making purposes. Costs must be associated with specific outputs, both intermediate and final as they relate to the various programs in the institution. Then it is possible to approach the specific decision making situation more intelligently. Decision makers in education are still faced with the problems of measuring the value of outputs so that cost benefit analysis can be done. As planning and control systems are developed, the cost side will become more and more exposed. It will then be necessary

to obtain better measures of output so that the loop can be closed. There are some dangers in developing the cost side extensively without adequate processes to measure the benefits. However, the author is of the opinion that having half the information is better than having no information. It will also put pressure on educators to start thinking about the measures of output that are suitable.

Another important use for cost data is a basis for projecting future costs of programs. More and more emphasis is being put on presenting budgets in program form to legislators. This necessitates the ability to structure cost data in this form. It requires models to assist the planner in making five year and ten year projections given alternative sets of criteria and objectives. Budgets can then be submitted that include alternatives with recommendations supporting the alternatives desired. The decision maker then has a basis (other than arbitrary) to make cuts or additions.

The next section of this chapter briefly summarizes some of the planning models and systems being designed in higher education to facilitate and improve the planning process.

PLANNING MODELS AND SYSTEMS IN HIGHER EDUCATION

MANAGEMENT INFORMATION SYSTEMS

GENERAL CONCEPTS OF MANAGEMENT INFORMATION SYSTEMS: The entire area of information systems and management information systems (MIS) is still in its infancy. Definitions and concepts appearing in the literature regarding information systems are still evolving. The term "Management Information Systems" has been used so many ways by so many people that the term is almost meaningless. "Difficult to define, design and justify, MIS remains a shimmering grail on management's' horizon". This is the lead to Robert Head's recent article in Datamation entitled "The Elusive MIS" [Head, 1970: 21]. There are many ways of approaching definitions of an MIS. Head cites that definitions are generally couched in terms of (1) Hardware, (2) Software, or (3) Management usage. Gordon Davis, Professor of Management Information Systems at the University of Minnesota, has structured some groups of terms under headings that help to draw some boundaries around the concept. They are listed in Figure 1.3.

M. H. Schwartz, assistant controller for information systems with the Atomic Energy Commission in a recent article on MIS Planning stated that

> Information processing systems become management information systems as their purpose transcends a transactions processing orientation in favor

Figure 1.3

Management Information Systems

An integrated, computer-based system to provide comprehensive, decision-oriented information to decision making persons in an organization.

Basic Elements
- Integrated
- Computer based
- System oriented (subsystems and modularity)
- Comprehensive decision-oriented information
- Flexible output
- User oriented output

Steps Toward MIS
- Clerical systems (process transactions)
- Integrated system with data base (retrieval)
- MIS (Process, retrieve, discover)

Conceptual Bases for MIS
- System Theory
- Information Concepts
- Management Theory
- Decision Theory
- Human behavior (man/machine system)
- Micro economics

Building Blocks
- Processing modules
- Decision models
- Data Management Systems (store, inquire, retrieve)
- Forecasting models
- Analysis models
- Simulation models

of a management decision-making orientation. Business transaction systems are one source of input data for Management Information Systems" [Schwartz, 1970: 28].

Head in another article uses a diagram that is helpful in structuring the concepts of trasactions processing and management information. This diagram (shown in Figure 1.4) shows the systems for different levels of decision making. The trend evolving in MIS is integrating and evolving lower level transactions systems into information systems for higher level decision systems. Data is extracted from these lower level systems and used together with additional data (economic, environmental and policy parameters), and models to provide information systems to aid the decision making process. Aron stated in an article in 1969 that

> The main difference to be expected between an integrated system and an MIS is that an MIS not only permits analysis of historical data, but it also permits the simulation and prediction of the consequences of alternative courses of action. Whereas an integrated system may provide reports on relationships of interest to management, the MIS might go further to provide reports on relationships that management didn't realize were significant [Aron, 1969: 213].

<u>MANAGEMENT INFORMATION SYSTEMS IN HIGHER EDUCATION</u>: The development of information systems on campuses to serve both day to day operational needs (Transactions data processing) and the information needs of higher level administrators are in various stages of implementation across the nation.* Systems to provide the day to day operational needs of colleges and universities were

*The WICHE Seminar Report, "Management Information Systems: Their Development and Use in the Administration of Higher Education", lists about fifty institutions that have made significant progress in approaching management information systems [Minter and Lawrence, 1969: 97].

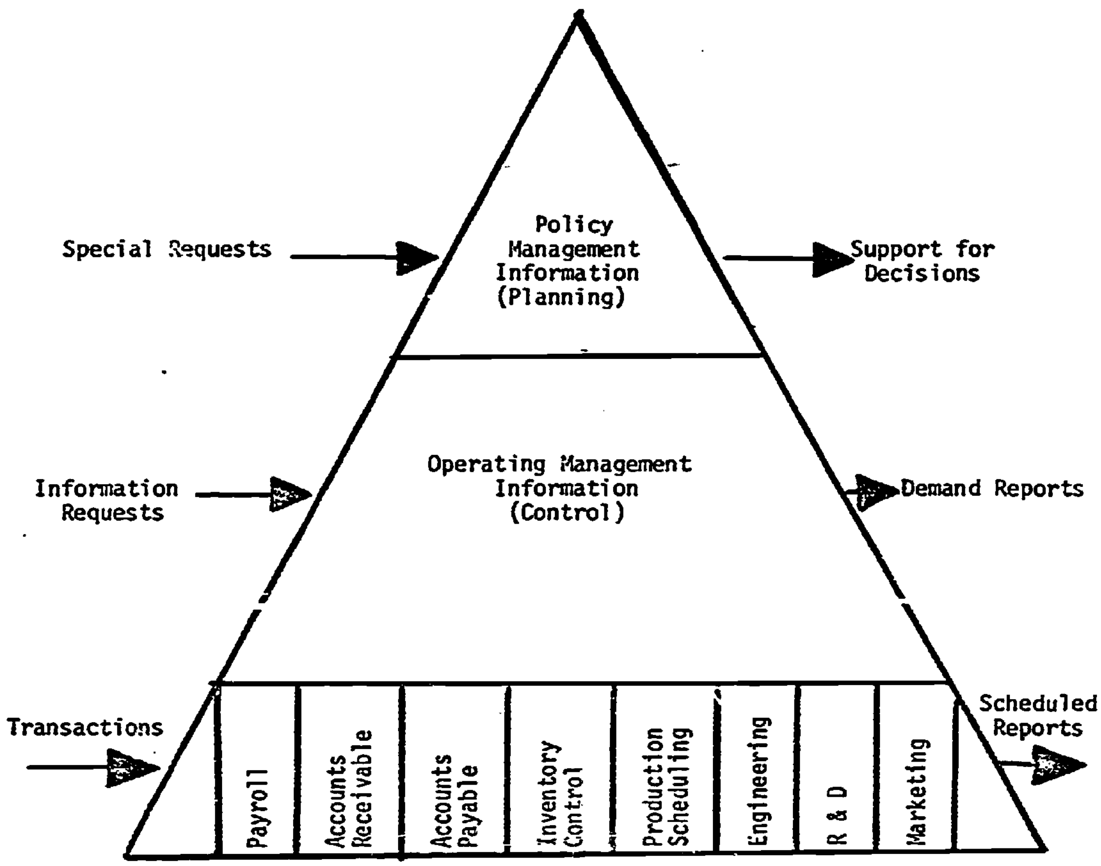


Figure 1.4

Information Systems for Different Levels of Decision Making

[Head, 1967: 22]

implemented on the computer in the early 1960's. In many cases small institutions that were able to gain access to a computer, and were able to attract someone with some experience had more functions operating by the mid 1960's than a lot of the larger institutions. Bemidji State College, a small state college in northern Minnesota with an enrollment of 4,000 had the following operations on the computer in 1967-68.

1. All registration functions.
    a. Class lists
    b. Drop and add updating
    c. Grade reporting
    d. Probation checks and reporting
    e. Transcript updating
2. Statistical reporting on students for state and federal reports.
3. Student accounting on fees and deposits using source record input with Hollerith punched ID cards.
4. Financial Aid award analysis and notification, account maintenance and collection systems.
5. Accounting system for departmental accounts on supplies and equipment.
6. Faculty information system that maintained historical data on salaries, promotions, tenure and rank.
7. Faculty load reporting system.
8. Dormitory room inventory and scheduling.

Larger institutions have had a more difficult time in implementing these transaction oriented systems. Size and complexity of the

organization has been one contributing problem, while a lack of competent staffing has been another.

Attempting to take the next step of progressing to some form of information system for management decision making in higher education has been a bitter struggle. This has been due to a number of reasons. (1) The existing confusion over what an MIS is as indicated in the first part of this section. (2) The difficulties that have been faced in just trying to implement the transaction oriented systems. (3) The difficulty of identifying goals, objectives, processes and the decision making system in a University environment.

Various efforts are in progress to evolve toward an information system to service higher level decision making systems in universities. The University of Utah has been spending 300 to 400 thousand per year during the 1969-70 period to develop systems with an MIS objective. Ohio State spent 1.13 million in 1968-69 for their total operational and developmental efforts in information systems. It is estimated that their information and control system costs them about $410,000 or $10 per student per year to operate [Minter and Lawrence, 1970: 97].

The University of Wisconsin initiated an effort during 1970 to install what they termed a "Planning Management Information System". The objectives of the system were as follows:

1. Provide information for supporting and analyzing the biennial budget request of 1971-73.
2. Provide information for supporting and analyzing

the annual budgets of 1971-72-73.

3. Provide initial data to implement program planning and analysis.

4. Provide initial data to be used in preparing responses to external requests for information regarding the operation of the University.

5. Provide initial data which will enhance the effectiveness of internal management [University of Wisconsin, 1970].

The system centered primarily around a scholarly activities report that was prepared on the computer initially with data from course and budget masters. The report was then distributed to each individual faculty member to obtain the amount of time spent on each of the activities specified on the report [A description of this form is covered in Chapter 2]. The form is returned, keypunched and processed to obtain the reports desired.

A significant effort underway that is giving direction to the development of information systems in higher education is the WICHE Program Management Systems (PMS) effort. "The overall objective of this program is to develop management information systems designed to improve decision making for resource allocation in higher education within the institution, at the state level and at the national level" [Johnson and Katzenmeyer, 1969: 111].

Program activities of the WICHE project during the period 1970-1974 will include:

1. A public explication of college and university

conceptual models.

2. The development of compatible data bases.
3. The development of procedures for obtaining and exchanging costs of instruction by level of student and field of study.
4. The conceptualization and development of analytical models designed to use the information generated through the program classification structure and its information categories to predict the consequences of various courses of action.
5. To begin the development of procedures or techniques for determination of the relationship between costs and benefits of the instructional functions.
6. To develop and encourage the development of training programs, short and long term, in the use and development of management information systems.

The emphasis initially will be on the educational programs, with work on the research and external service coming later [Johnson and Katzenmeyer, 1969: 116].

The WICHE effort has attempted to design information structures so that they are flexible in meeting the needs of all levels of decision making in higher education. They have attempted and are moving toward achieving compatibility in reporting systems so that levels can be aggregated meaningfully.

Much of the current effort in the WICHE program is directed toward the development of information systems for decision

making. This is demonstrated by its emphasis on the development of planning models [The WICHE model, RRPM, will be discussed in Chapter 2]. The significance of the WICHE PMS project can be measured somewhat by noting the list of publications that are currently available as a result of this effort [Farmer, 1970] [Huff, 1969] [Minter and Lawrence, 1969][Thomas, 1970] [Gulko, October 1969] [Huff, January 1970] [Lawrence, Weathersby and Patterson, 1970] [Gulko, January 1971a and b] [Gulko, June 1970], and by noting that there are over 350 institutions that are participating in some form with the project.

PLANNING, PROGRAMMING, BUDGETING SYSTEMS (PPBS)

GENERAL CONCEPTS OF PLANNING, PROGRAMMING, BUDGETING SYSTEMS: PPBS has been receiving a lot of attention by various government agencies since its inception in the Department of Defense in the early 1960's. David Cordes has recently compiled an annotated bibliography consisting of 375 references on PPB [Cordes, March 1971]. PPB like MIS, is another difficult concept to define. The term has been applied to many systems ranging from the simple systems of reorganizing line item budgets into program budgets to the complex integrated systems of the Department of Defense [United States Congress, 1969].

Basically PPBS integrates the various elements of planning and control into one coordinated system.

> PPBS is a system of concepts and techniques for decision making which makes resource allocation decisions more rational and programming more effective. Concepts and methodologies relating to PPBS

are: program budgeting, benefit/cost, cost effectiveness, cost/utility, operations research, systems analysis, etc. The major contribution of PPBS over traditional budgeting systems lies in its potential for integrating planning, programming and budgeting processes. Planning in this context refers to the process of identifying alternative long term objectives. Programming optimizes the mix of resources to achieve specific multi-year plans consistent with the long term objectives established in the planning process. Budgeting is the detailed short term (one to five years) resource plan for implementing the specific multi-year program plan selected in the programming process. System then refers to the interrelationships among planning, programming and budgeting PPBS conceptual and operational integration; feedback and updating of objectives and programs [McGivney and Nelson 1969: 5]

The basic purpose of PPBS is twofold:

(1) to serve as a vehicle for getting better management in order to improve the effectiveness of resource allocation in universities, and

(2) to show the government, the public and the promoters of funds what is being bought with the resources available to the university.

The operational objectives of PPBS are as follows:

(1) to encourage decision makers to formulate objectives and to relate the programs of the university to those objectives.

(2) to stimulate analysis of all existing and proposed new programs in terms of costs and effectiveness.

(3) to develop a long-term planning and programming system whereby future implications of present and proposed policies are explicitly considered.

(4) to translate the traditional line item budget into a program budget which shows for each program the expected resource requirements and results.

(5) to develop an integrated information system to serve all areas of management within the university and to provide the necessary data for planning and analysis using simulation

models and for the evaluation of the educational effectiveness of programs.

(6) to provide a systematic way of integrating all of the above elements in order to arrive at a more effective system for allocating and managing resources [Van Wijk, Judy and Levine, 1969: 10].

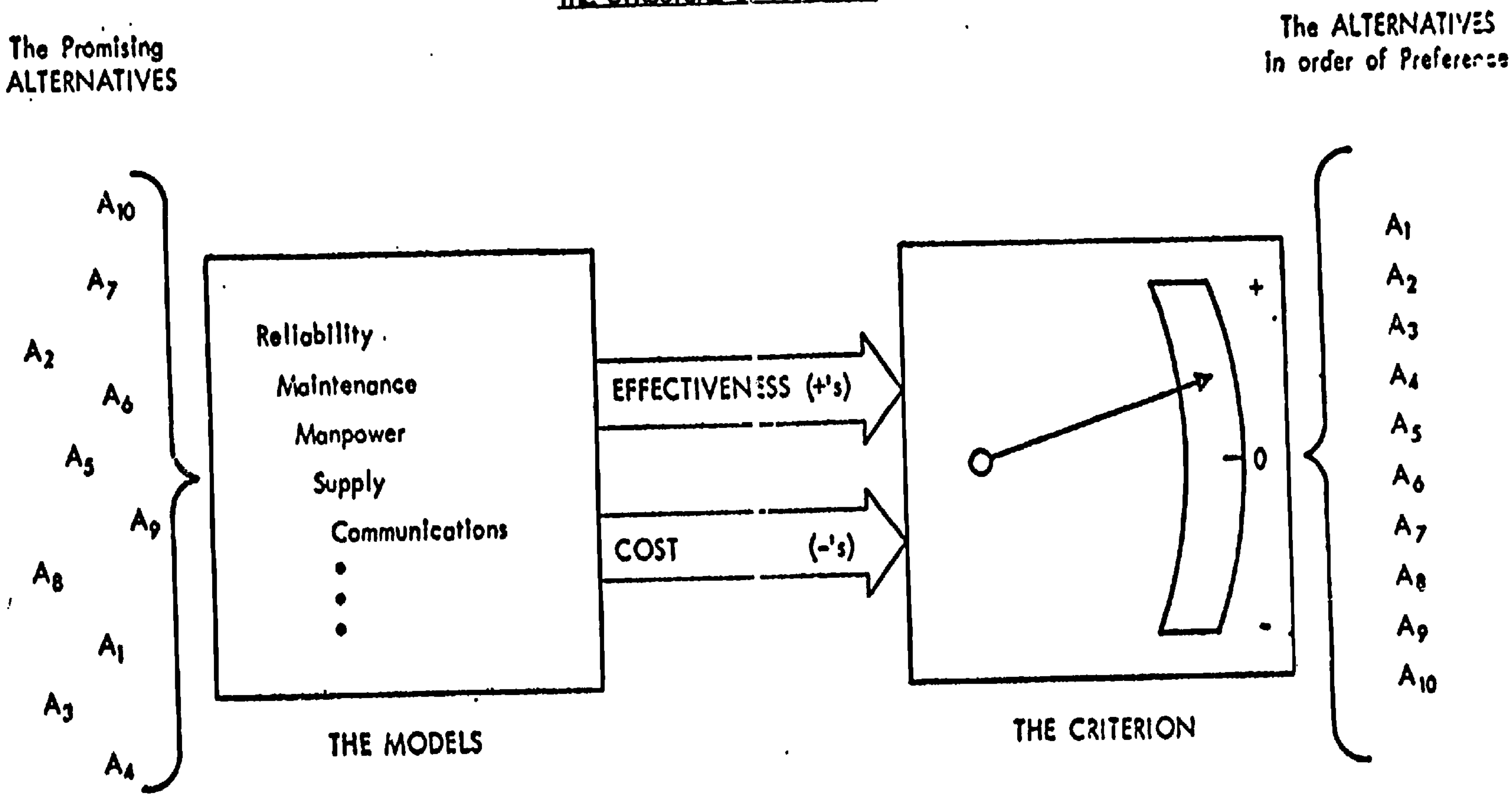
PPB Systems go beyond the traditional budgeting systems and consider outputs (benefits) as well as the inputs (resources). Consequently, a PPB System can give one the ability to look at cost effectiveness of alternative combinations of input to obtain the output desired. Figure 1.5 illustrates the concept of cost effectiveness.

PPBS is also an iterative and continuous process. Objectives and alternatives for meeting those objectives must continually be reviewed. Review requires data collection, the structuring of data into information, and the analysis of this information. Figure 1.6 shows the various elements involved in this analysis process. PPBS requires the support of a Management Information System. Cordes [Cordes, 1970, 10] states that "Information is the heart of analysis." He further states that "often times this information cannot be provided by the organization's existing Management Information System (MIS) because analysts require data that is significantly different from that maintained in a traditional 'MIS'." [Cordes is equating the traditional MIS to transaction data processing systems.]

The important aspect is that the information system is compatible to, and integrated with the PPB system. This does not mean that

FIGURE 1.5

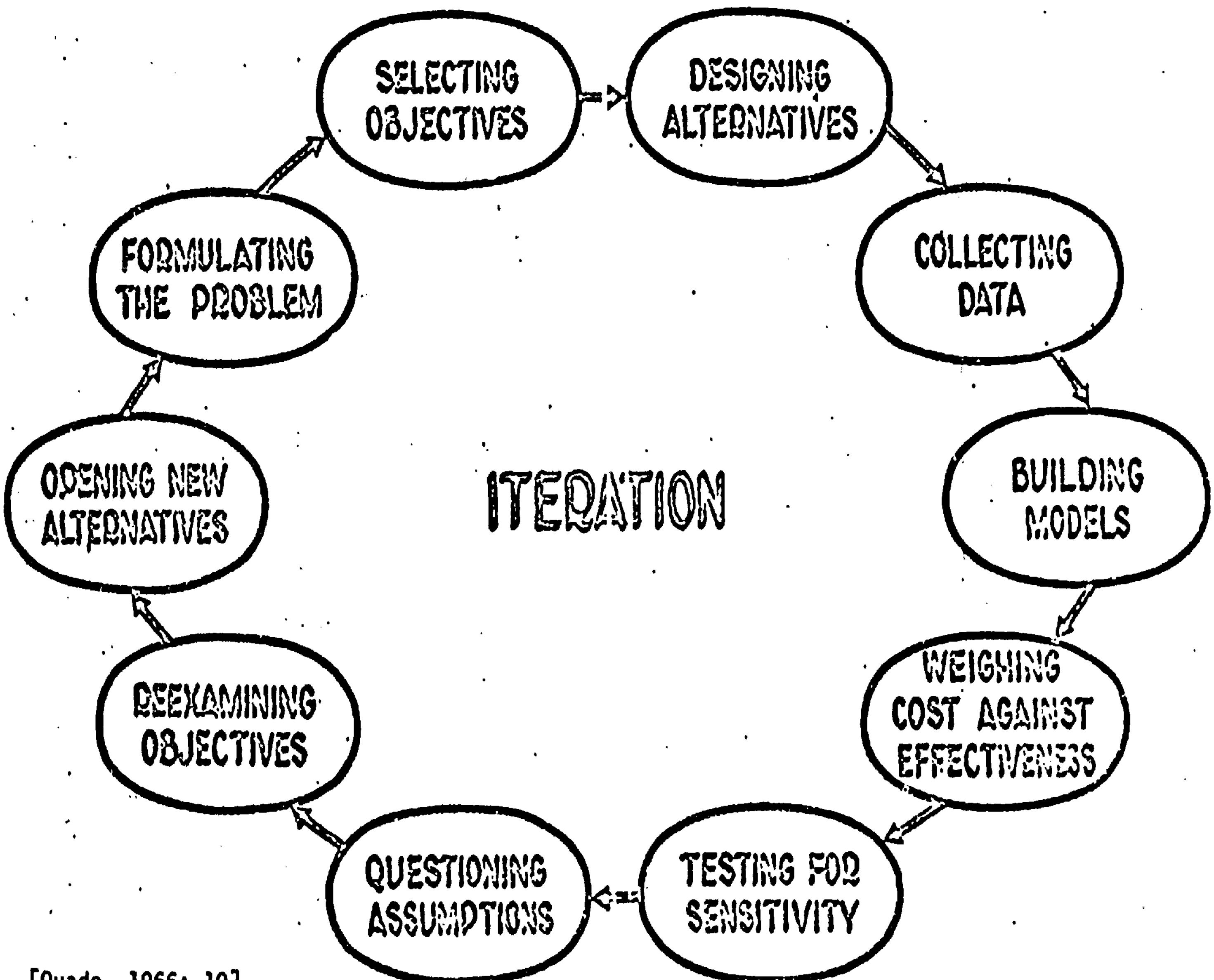
THE STRUCTURE OF ANALYSIS



[Quade, 1966: 9]

FIGURE 1.6

THE KEY TO ANALYSIS

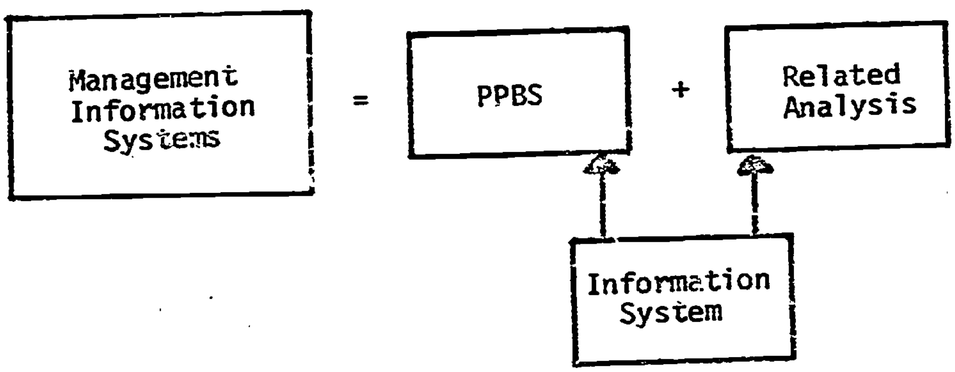


[Quade, 1966: 10]

the information system has all the information required for the planning process, but that is has the basic data so that information for analysis, models and decision processes can be derived from it. WICHE refers to PPBS as a subset of MIS.

FIGURE 1.7

RELATIONSHIP OF PPBS AND MIS



The objectives of a PPB System are in the same direction as the objectives of an MIS. The field of PPB Systems has helped to strengthen this direction by placing emphasis on "objectives" and "cost effectiveness".

PLANNING, PROGRAMMING BUDGETING SYSTEMS IN HIGHER EDUCATION: The interest in PPB Systems in higher education has increased considerably in the past two or three years as legislatures began to ask for various state agency budgets in program form.

> It is important to understand the 'new environment' of higher education in order to understand the motivation of those outside the higher education community to strongly support PPBS. First, higher education is now competing with many significant social problems for funds. Second, higher education is now a closed

> economic system--there are no independent institutions. Third, there has been an acceptance and use of program budgeting by the federal, state, and local governments, and by business [Farmer, 1970: 4].

Although the trend is toward PPB, it will be sometime before it is implemented on a large scale. There are two basic reasons for this: (1) Resistance to a system that will give more data to outsiders. (2) Difficulty in implementation - i.e., understanding, adaptability, and feasibility.

Resistance: The resistance is for two general reasons: (1) Universities are concerned about losing control of how they spend money by giving outsiders information on costs by programs. (2) There is concern over the interpretation of data developed in program costing systems.

> There is a significant danger from misinterpretation of the data generated from program budgeting. Legislatures and control agencies could impose counter-productive charges through misunderstanding [Farmer, 1970: 6].

Cost measurement is not an exact science. Many arbitrary allocations are involved. There is no one cost that is useful for all purposes or all decisions. Consequently, the interpretation of a cost must be made in context with the decision that is being made and with an understanding of how a particular cost was derived.

Implementation problems: A PPB System is not easy to implement. It requires a significant commitment of resources to design an operational system, train the users and convert the present systems. It means overlaying present systems with more classification systems. Consequently the complexity increases. The

big question is, Is the information obtained worth the process to obtain it? "PPBS must itself, as it requires of the programs themselves, pass the test of cost-effectiveness" [Farmer, 1970: 3].

There are many deficiencies in the concepts of PPBS in higher education.

1. It is difficult to identify and measure the outputs of higher education especially quality.
2. There is no single unit that produces a unique output.
3. Production functions for higher education are not known [Farmer, 1970: 9].

Although there are many problems facing the implementation of PPBS in higher education, it appears that with further research, there will be a lot of potential for its use.

MODELS AND SIMULATION

MODELS AND SIMULATION CONCEPTS: Models have been used to represent reality in all phases of man's environment. Maps, charts, scaled down representations, the engineers bread-board model are all examples of the use of models. There is another type of model that has become much more adaptable to real world situations since the advent of the computer. This is the functional or mathematical model. The mathematical model describes the flow process and relationships of a system. One element in a system can be described mathematically in terms of another element. For example, space required for a particular class can be a function of the number of students in the class, and the number of students in the class can be a function of the number of students in curriculum drawing on that class, etc. Models are useful

to experiment with situations in the real world where it is impossible or excessively expensive to manipulate the real world. They are also useful as a method of understanding the real world process. Models are generally used in the following ways:

1. They may permit feasible and economical experimentation on real world systems without incurring the costs, risks, and expenditures in time which may be required in actuality.

2. They allow us to formulate, communicate, and discuss hypothesis.

3. They bring about an understanding of the system variables and their relationships.

4. They make it possible to forecast and project for planning and decision making.

5. They allow control of the time scale. Real world processes occur over long periods of time. Modelling can allow long time intervals to be collapsed.

6. They enable us to control and monitor real world processes [Naylor, et. al., 1966: 8].

Model construction involves identifying the critical elements of the system being modeled and their relationships. Martin calls this the conceptualization phase in implementation [Martin, 1968: 163]. It involves defining the problem, analysis, definition of parameters and variables, determination of information and data requirements, collection of data, adoption of hypothesis, determining measures of effectiveness, and the determination of approximation procedures. The abstract model is then translated into an explicit model through flow charts, equations, and computer code. The final phase is to run the model feeding it with a set of data that hopefully can be validated with the real world. Validation of the model is a big problem in simulation. Does the

model represent the structure of the real world? Do the input parameters represent the parameters of the real world? Is there a real world situation to check against?

Simulation models do not produce automatic decisions. The administrators task is to (1) clearly define institutional objectives, (2) identify alternative future programs, (3) simulate results of alternative programs through the use of models and (4) implement programs judged to be most consistent with the objectives [Huff, 1969].

MODELS AND SIMULATION IN HIGHER EDUCATION

A number of models have been built to simulate various processes in higher education. Juan Casasco [Casasco, 1970: 72] reviewed over forty models and reported on twenty one in his study. He categorized the models into comprehensive or specialized with a further breakdown on operational versus developmental. Of the twenty one models reported on in the study, seventeen were classified as operational. A comparative matrix listing the models studied as well as how they were classified is shown in Figure 1.8. However, one must be careful in the use of this data since Casasco's interpretation and classification may not be the same as the reader's. Also his sources were often publications written by the model's authors who tend to be over optimistic about what the model can do. Casasco has put both the CAMPUS model (Number 3) and the Stanford model (Number 17) under the classification of a Data Management System. However, there is a big difference in the data management capabilities of these two. The Stanford model's

FIGURE 1.8
COMPARATIVE MATRIX OF PLANNING ELEMENTS

	Management			Projections			Resource Allocation		Physical Facilities					Scope & Status of Study					
	Management Information System	Data Management System	Program Evaluation and Review	Enrollment Calculations	Budgeting Calculations	Land Use Requirements	Cost-Benefit Analysis	Cost Simulation Models	Space Requirements	Costs of Facilities	Maintenance Programs	Computer Graphics Simulation	Space Allocation Model	Comprehensive	Specialized	Developmental	In Progress	Completed	Operational
1. University of California				X				X	X			X		X				X	
2. Michigan State University				X				X				X		X				X	X
3. University of Toronto Campus	X	X	X	X		X		X	X					X				X	X
4. Peat, Marwick, Mitchell & Co. SEARCH	X	X		X		X		X						X				X	X
5. University of Rochester	X			X					X			X		X				X	X
6. University of Washington				X	X							X	X		X			X	X
7. Dominguez Hill State College		X		X											X			X	X
8. Tulane University				X		X		X							X			X	X
9. Massachusetts Institute of of Technology		X							X			X	X		X			X	X
10. University of Wisconsin				X					X						X			X	X
11. Pittsburgh Board of Education									X	X		X			X			X	X
12. Skidmore, Owings & Merrill BOP									X	X					X			X	X
13. UCLA-Library Hours							X		X	X					X			X	X
14. Rensselaer Polytechnic Institute				X					X	X		X			X			X	X
15. R P I - MEMOPAD		X									X				X			X	X
16. P M M - RAPID				X		X		X						X		X		X	X
17. Stanford University - INFO		X		X		X									X	X	X		
18. Princeton University			X			X		X							X	X	X		
19. Caudill Rowlett Scott				X					X			X			X			X	X
20. C O R E L A P									X			X			X	X		X	X
Frequency of Occurence	3	6	2	14	1	7	1	8	12	4	1	9	2	6	14	5	2	19	17

primary objective is to function as a generalized data management system in higher education. Whereas the CAMPUS model has only a limited amount of data management capability, its primary objective is to operate on the data that is extracted from a data base. In general, Casasco's study is a good survey of the characteristics and emphasis of models in higher education. There are two main parts to a mathematical model of the type referred to in Casasco's study. First, one must construct the model itself (i.e., develop each mathematical relationship), and second, one must supply the parameters and data for the model to operate on. Some models are classed as very aggregate models, others are classed as very detail models. As models become more detailed, the number of relationships and the number of parameters tend to expand geometrically. Aggregate models in higher education tend to work primarily with gross regression equations. Enrollments are fed into the model and costs are projected by departments or discipline, with very little breakdown in the type of cost. Most of the models fall into this category [Weathersby and Weinstein, 1970: 12].

CAMPUS falls into the category of a dissaggregate model. It is the most comprehensive of all the models reported on by Weathersby and Casasco. CAMPUS requires data down to the course level of detail, quarter by quarter. Staffing requirements can be altered for specific courses in any year of the simulation. Some of the parameters that can be altered include: (a) amount of credit per contact hour given for teaching a course (per rank

within cost center); (b) amount of credit given per faculty for specified non-teaching duties (per rank within cost center); (c) salary and inventory by rank and cost center; (d) hiring policy and restrictions.

The CAMPUS model can be used to simulate the effects of changing these parameters or other parameters that have an effect on staff time; for example, CAMPUS was used in one division at Bemidji State College to simulate the effect of changing the teaching load from 12 to 14 hours. Another experiment was to look at the effects of teaching all introductory courses in a particular department in sections of 500 and all other courses in sections of 25. Once the original base of data is set up, it is not difficult to use CAMPUS to simulate the effects of different alternatives. Chapter two will go into more discussion of the data required for the staffing modules of CAMPUS.

THE ROLE OF FACULTY ACTIVITY ANALYSIS IN PLANNING MODELS AND SYSTEMS

The financial situation in higher education as noted earlier in this chapter has increased the need for better planning and cost analysis. Planners and administrators are concerned with "unit costs", costs by level of instruction, costs per degree or program element and costs by program. These costs are presently difficult to derive and interpret because data is not available. Consequently, in order to do better analysis and obtain better measures of cost, more data is required on how the inputs are being allocated to the production process in higher education.

> When one considers that over 80% of the resources used in the Primary Academic Areas are in support of faculty and staff activities and that, for the most part, these activities can support more than one "process", the need for faculty activity analysis becomes obvious. It becomes the logical keystone to identifying the direction and purposes to which resources are being applied. In addition, because there are so many concerns about faculty accountability for professional services rendered, it is logical to include this accountability under the umbrella of faculty activity analysis. Finally it is important to know both the nature and magnitude of support of processes by faculty and the current scope of activities performed by faculty in order to plan, compare alternatives, and evaluate change [Inter-University Council of Ohio, 1970].

Faculty resources represent the largest current expenditure input to the production process in higher education. During the fiscal year 69-70, $21.2 billion was spent on salaries for instruction [College Management, January 1971: 1]. This does does not include salaries for administration and organized

research which is another large portion. Faculty salaries have been rising five percent to seven percent per year over the past ten years [College Management, January 1971: 12]. The weighted average salary across all ranks at the University of Minnesota rose from $9039 in 60-61 to $14,696 in 70-71. This is a 53 percent increase over the ten year period [Memo V.P. Smith to Deans, 1970]. In addition to faculty salaries increasing, the numbers of faculty will also continue to increase to keep up with demand.

Since faculty represent the major resources in the production process of the University, it is important to know how this resource is being used and how it is distributed to the programs of the institution. When one is concerned about the costs of particular programs, he is concerned with the direct costs affecting that program. How much faculty resources is a particular program drawing? When one is considering the addition and/or deletion of programs he is concerned about what effect it will have on resources. Projections on faculty time must be considered to determine this effect. When alternatives are considered, differences in demand on faculty time generally represent the major variable.

The combination of the economic impact of faculty salaries and the need for cost analysis has emphasized the need for more analysis of faculty activities. Data on faculty effort and how it is distributed is the key to more meaningful cost analysis. Faculty effort data is required to (1) drive the models, (2) to provide

the initial inputs to activity and program costing in PPB Systems, (3) to provide the data for effective planning at the operational level (department) and (4) to provide the parameters needed to support analysis in PPB systems and input-output analysis.

> At the heart of a college's problem of resource allocation is the disposition of its primary resource-its faculty. In a modern American institution, the typical faculty member engages in a bewildering array of activities that may be considered germane to the mission of the institution and its role in society and which the institution wants to support [Goodwin, 1970: 6].

Faculty activity analysis is also necessary for administrative processes at the departmental level. The equitable treatment of faculty within and across departments is an item of importance to the individual faculty member. The department head must consider the objectives of the department, the objectives of the school, the demands of the students, and the characteristics and demands by the individual faculty members in accomplishing the tasks of the department.

PURPOSE AND SUMMARY OF THE STUDY

PROBLEMS IN FACULTY ACTIVITY ANALYSIS

There are many problems currently associated with the entire area of faculty activity analysis. The problems can be grouped into the following classifications.

1. Activity Definitions.
   a. Which activities of the faculty member are relevant to the purpose of studying faculty activities?
   b. How should activities be grouped?
   c. What is the crosswalk between all of the possible activities of a faculty member and the reporting format of activities?
2. Measures of Faculty Activities.

   What should be used as a measure? Average hours per week, total hours per quarter, percent of time, credit hours, numbers of students, numbers of committees, numbers of advisees by level are all measures that have been used in the past.
3. Population problems.

   Who should be included in the population and how should each be handled is a continuing problem. Researchers, administrators, lecturers, teaching assistants, split appointments all confuse the situation.
4. Acceptance by the Faculty.

   Faculty are not accustomed to having to report on what

they do. Many have entered the academic profession because of the freedom characteristics that have been associated with academia. Education programs are required to gradually turn this thinking around. The relationship between faculty activity data and its use and effects in planning must be demonstrated to the faculty to gain their support.

5. Accuracy of the Data Collection Method.

   Methods of data collection have been one of the most perplexing problems surrounding faculty activity analysis. Most of the efforts have used a census approach.* However, there has been considerable concern over the accuracy of this approach. Consequently, there is an effort to explore other methods of data collection that will better satisfy the accuracy requirement. Some work has been done using logs or diaries (University of Minnesota Veterinary School, 1968, and School of Agriculture, 1971; British Grants Commission, 1969). Other work has been done using sampling and interview techniques (University of California, 1970: Ritchey study, 1959).

CONTRIBUTION OF THIS STUDY

The purpose of this research was to explore another sampling method using the technique of "self-sampling". This means the faculty member samples his own activity over a period of time using a random alarm device to indicate the points to be sampled.

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*A summary of various efforts is reported on in Chapter 2.

There were two primary objectives of the study.

1. To determine if there was a significant difference between the data obtained via self sampling and the data via estimates.
2. To determine if self sampling can be used in a faculty environment, and if so what sampling structure is most feasible.

The major hypothesis that addresses itself to objective number one is: Experiment data (self-sampling data) equals estimates.

This hypothesis was tested under varying conditions.

<u>Hypothesis 1.1</u> Experiment data equals period estimate: Twelve week estimates.

<u>Hypothesis 1.2</u> Experiment data equals period estimate: Six week estimates.

<u>Hypothesis 1.3</u> Experiment data equals period estimate: Three week estimates.

<u>Hypothesis 1.4</u> Experiment data equals period estimate: Aggregate.

<u>Hypothesis 1.5</u> Experiment data equals period estimate: Aggregate - No personal time work.

<u>Hypothesis 1.6</u> Experiment data equals period estimate: Aggregate - No administration.

<u>Hypothesis 2.1</u> Pre estimates (estimates at the beginning of the quarter) equal experiment data.

<u>Hypothesis 2.2</u> Post estimates (estimates at the end of the quarter) equal experiment data.

Four hypotheses have been set up to address the second objective.

<u>Hypothesis 3.1</u> Self sampling is preferred to estimating methods for gathering data on faculty activities.

<u>Hypothesis 3.2</u> A period of three to four weeks is about the right length of time for a faculty member to

carry the device.

<u>Hypothesis 3.3</u> Faculty members would rather carry the device for a short period of time with a higher frequency of points per day than to carry it for a longer period of time with a lower frequency of points per day.

<u>Hypothesis 3.4</u> An average of one alarm per hours is a reasonable number of points per day.

A secondary objective of the study was to develop parameters for Project PRIME (Planning Resources In Minnesota Education). Project PRIME was a test implementation of a computer simulation model in higher education called CAMPUS [Reference Appendix A]. An analysis was done using the CAMPUS model to compare the differences between the parameters based on this study with the parameters based on the Bureau of Institutional Research study, Fall quarter, 1969. The analysis of these differences was done on both the inputs and the outputs.

<u>Hypothesis 4.1</u> There is no significant differences between the CAMPUS outputs using Winter 1971 parameters versus using Fall 1969 parameters.

<u>SUMMARY OF THE RESEARCH</u>

Chapter two is a review of the literature relating to faculty activity analysis in the past. This review is broken into three major categories. (1) Defining Faculty Activities, (2) Faculty Activity Measurement and Data Collection, and (3) Uses of Faculty Data. In each section an attempt was made to survey what has been done in the past and what is being done currently in institutions.

A comprehensive mailing was not sent out to obtain information on forms and systems presently used in institutions to gather faculty

activity data. However, some letters were sent to obtain information on specific systems such as the one in Ohio [Ohio State University, 1970]. Another source the author reviewed were the files at WICHE in Boulder, Colorado. They had sent a mailing to all their members obtaining information on current systems being used to collect data on faculty.

Chapter III is an explanation of the experiment that was done as a part of this research. It describes the population, the self-sampling method used in collecting the data and the category definitions used in this study. A few self sampling studies are reviewed as an introduction to this chapter to familiarize the reader with the self sampling technique. All of the studies that the author was able to find on self sampling are referred to.

Chapter IV summarizes the results of the experiment described in Chapter III. Hypothesis are tested and the statistical results are reported. Chapter V summarizes the study and discusses implications for further research.

There are twelve appendices included in the back that may be referenced for particular detail on certain related aspects of the study. Appendix A describes Project PRIME, the project that is supporting this research. Appendix B discusses various self sampling devices and where they can be obtained. Appendix C shows an example of each form and document used in this study. Appendix D describes a faculty information system and how it could be linked to the CAMPUS model. Appendix E contains a short

description of the program used to edit and report on the data. Appendix F describes how work sampling works. Appendix G, H, I, and J summarize load formula studies, cost studies, a diary study and self sampling studies that are referenced in various parts of this dissertation. Appendix K contains the cost center output reports from the simulation runs done in this study. Appendix L shows two examples of faculty activity report forms currently used in institutions.

CHAPTER II

A SURVEY OF FACULTY ACTIVITY ANALYSIS

DEFINING FACULTY ACTIVITIES

PROBLEMS OF DEFINING FACULTY ACTIVITIES

Defining what faculty do and what should be measured as a part of faculty load is a difficult problem. W. Hugh Stickler in preparing working material and a bibliography on faculty load used the following definition.

> Faculty load includes the sum of all activities which take the time of a college or university teacher and which are related either directly or indirectly to his professional duties, responsibilities and interests [Stickler, p. 80].

This definition is very broad and not very helpful in setting up criteria for what should be included in faculty load. Activities which are related either directly or indirectly to professional duties, responsibilities and interests make it possible to include almost every activity except eating, sleeping, and time with the family. One can consider the activities of a faculty on a continuum. Then one is confronted with the following problems: (1) Where do specific activities fall on the continuum and (2) where on the continuum does one stop measuring activities. There are many activities that are easy to accept as definitely being included.

1. Class contact
2. Grading papers
3. Preparing exams
4. Administrative tasks
5. Attending faculty meetings

6. Counseling students
7. Working on an organized research project
8. Serving on committees
9. Preparing class materials for a lecture in a current course.

There are many more activities that fall into the grey areas.

1. General reading
2. Participation in student discussions
3. Participation in faculty discussions
4. Individual research
5. Consulting
6. Public service functions
7. Advising student organizations
8. Attending seminars
9. Writing a textbook
10. Writing an article

It is difficult to handle the activities of a professor that are not directly assigned as his responsibility. If he is assigned to a course, then all activities related directly to teaching that course are definitely included. If he is assigned to a faculty committee, then all activities related directly to this function are included. If he is assigned to a research project that is organized and specifically funded through the institution, then there is no question of these activities being included. However, if the faculty member decides to do research in some area which has not been specifically assigned or funded, is this a part of his load? The answer to this question may depend or

the policy of the institution. Is research required? Is it assumed that one does research because of his reduced teaching load?

How much professional development is required or should be classified as part of the load? Does reading a journal article in the professional field constitute professional development? What about reading the daily newspaper? These are difficult questions to answer because of a lack of criteria.

In industry all professional development outside of the job (i.e., not on company time or funds) would not be considered part of the hours spent on the job. The criteria tends to be whether you are on the job or not. Therefore, if a data processing manager is reading Datamation at work, it is part of his job. If he reads it at home, it is considered as a part of his own professional development. This problem is different with faculty. Except for his class hours and office hours, the faculty member is free to spend his time where and how he wishes. Consequently, where he reads a journal has no bearing on whether it is a part of his job. Theoretically all outside work of the professor not specifically assigned could be classified as professional development and not counted as part of the load at all. Or it may be recognized, but only up to some set standard. Extra hours beyond this standard would be the desire of the individual faculty member and would be treated the same as the manager of data processing reading Datamation at home.

Another dimension influencing the problem of defining faculty load is all of the factors that affect the size of the load. Load is not just the activities assigned and worked on by a faculty member. Load is also affected by the: (1) Type of class (lecture, lab, independent study), (2) Type of course (theory, philosophy, problems), (3) Number of students in the class, (4) Number of preparations, (5) Number of advisees, (6) Number of students in paper stages at the Masters and Ph.D. levels, (7) Number of times each course has been taught before by this instructor, (8) If the course is new in the curriculum, the development stage of the course, (9) The experience of the instructor in the subject field, and (10) The amount of clerical or teaching assistants available to the instructor. For more discussion on this, reference Appendix G.

The problem of defining faculty activities has been expressed by a number of writers. Forty years ago Reeves and Russell stated:

> The evaluation of faculty load is an extremely difficult problem. Teaching duties vary tremendously from institution to institution and from individual to individual within a given institution. In fact the factors involved in determining total faculty load are so numerous and so varied as almost to preclude precise determination by any mechanical method. No thoroughly scientific method of measuring faculty load is now available. Existing measures are unsatisfactory and incomplete. The answers are not yet in. Yet as a practical necessity, some method of measuring and adjusting faculty load--even though only approximate--must be employed [Reeves and Russell, 1929: 165].

That was the situation in 1929. The situation today is no different.

There was a flurry of activity to study the problem in 1959 and 1960. A conference on the measurement of faculty work load was held at Purdue University in 1959. A report published as a result of this conference [Bunnell, 1960] had in it a number of papers related to the problem of defining and measuring faculty work load. The report also contained an extensive bibliography up to that period of time. Since that time there was not been much activity. In 1961 John Stecklein, Director of Institutional Research at the University of Minnesota published a monograph on "How to Measure Faculty Work Load" [Stecklein, 1961]. His monograph discussed the uses or values of faculty work load studies and some of the various methods of measuring faculty work load. He also makes recommendations concerning the formation of a faculty advisory committee, determination of guiding policies, development of report forms, content of these report forms, distribution and collection of forms and the tabulation, analysis and reporting of results.

Very little work has been done to improve the state of the art in faculty activity analysis during the 1960's. The author reviewed Dissertation Abstracts,* the Education Index,** sent out a number of letters, used the Datrix System at University

*Dissertation Abstracts (Ann Arbor, Michigan: University of Michigan).

**Education Index New York: The H.W. Wilson Co., 1960-1970).

Microfilms* and reviewed the files of WICHE in Boulder, Colorado. The results of this search are recorded in the bibliography. The bibliography is not exhaustive, but it includes a significant amount of the work done before 1960 and all of the references the author could find relating to the faculty activities after 1960. The number of institutions doing work on faculty studies has increased during the 1960's. This is evident in reviewing the systems presently in operation in various institutions [See Figure 2.2]. The reasons for this are the pressures cited in Chapter 1 and the development of more data on the computer making it easier to run some of the studies. This is especially true of studies that involve just credit hour, contact hour and full time equivalent (FTE) measures.

The most significant effort in advancing the state of the art in Faculty Activity Analysis is the effort currently being worked on by WICHE. The effort is coordinated by Leonard Romney, Staff Analyst for WICHE. Assisting on the project has been

Gary M. Andrew
Associate Professor
School of Business Administration
University of Minnesota

Donald Lelong
Director, Office of Institutional Research
University of Michigan

Burton Wolfman
Associate Director
Office of Analytical Studies
University of California

*University Microfilms, Ann Arbor, Michigan. Key word search on dissertations from 1956 to 1970. Key words used were Faculty and Load, Sampling, Information, Allocations, Assignment, Study, Questionnaire, Schedule.

Geor_ · Baughman
Director, Administrative Research and Systems
Ohio State University

The project is scheduled through 1975 with additional manpower to handle the tasks that are planned. More references to the WICHE project will be made as they relate to the next sections of this chapter.

FACULTY ACTIVITY CATEGORIES - PAST STUDIES

Faculty activity studies in the past have had varied forms of activity categories. Many differences are due primarily to different terminology for the same activities. Other differences are due to combining elementary tasks into different combinations in making up the main categories. The varied forms of activity categories cause two problems. (1) A good understanding of how activities should be classified is never accomplished by faculty and users of the data, and (2) the data is not very useful in comparisons from institution to institution or from year to year if the category structure does not remain constant. The category structures of a number of past studies were reviewed by the author. Figure 2.1 summarizes into a common format the categories used in these studies.

Figure 2.1 shows that research, public service, and some levels of administration have been a part of faculty activity studies since the 1920's. Both Davis [1924] and Ayer [1929] mention these categories as well as some form of professional development. Contact hours appeared to be a more significant measure than the use of credit hours. However, in many of the studies, both contact

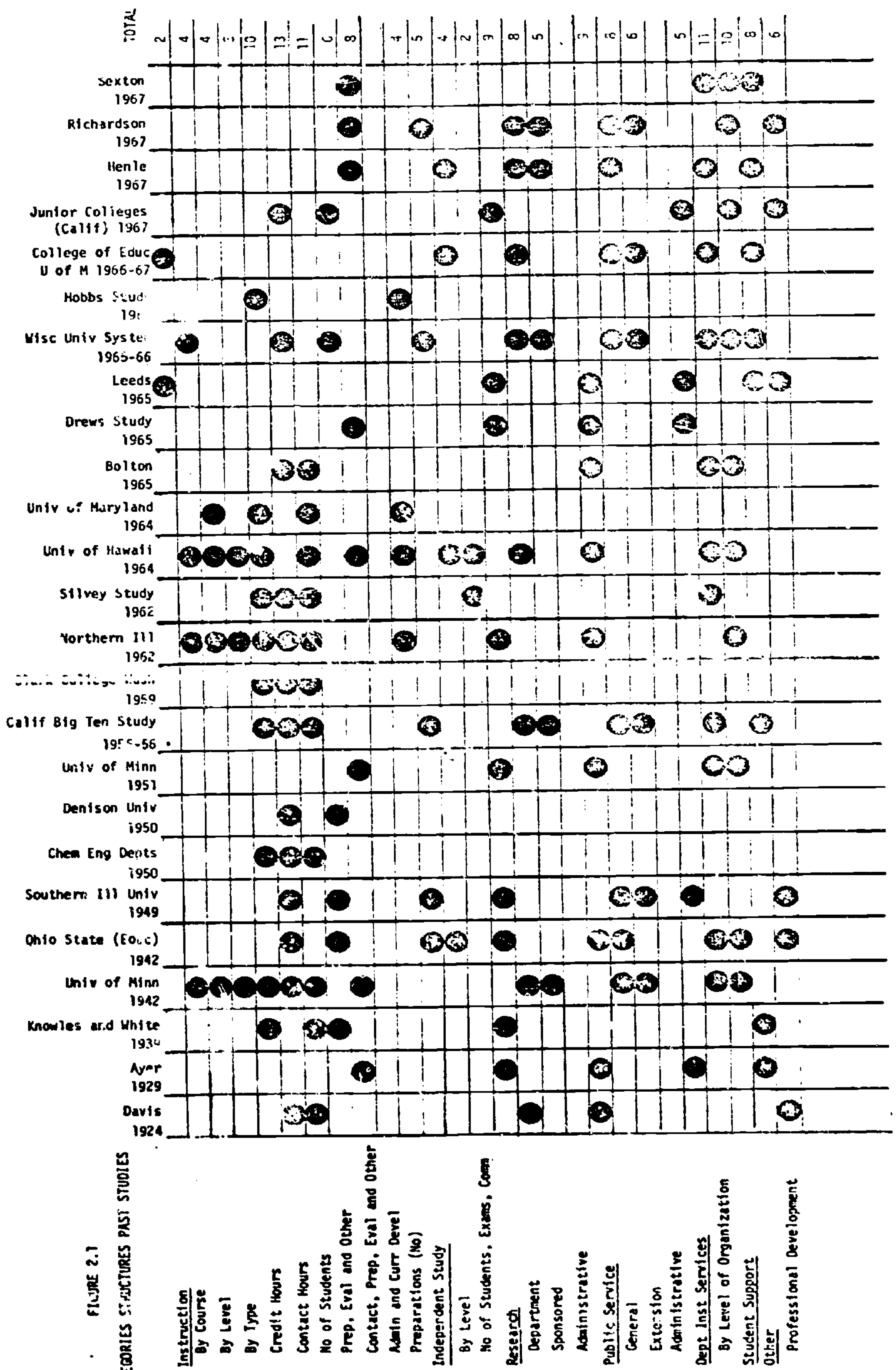


FIGURE 2.1

CATEGORIES STRUCTURES PAST STUDIES

hours and credit hours were used. A significant aspect of these past studies is that very few collected data by individual course. Apparently there was more interest in obtaining aggregate data by category than obtaining a breakdown within category. Most of the data was picked up via questionnaires with very few using computer files to extract any of the data. Most of the studies were in hours rather than percent, and almost all of the studies were special studies. A few of the studies had comprehensive sets of categories. These included the University of Hawaii, Eastern Washington State College, California and Western Conference Study, College of Education, at the University of Minnesota, the University of Minnesota and the University system of Wisconsin.

FACULTY ACTIVITY CATEGORIES - CURRENT STUDIES

More and more institutions across the nation are initiating periodic studies or continuing studies on faculty activities. Some of the systems collect data quarterly as a regular process, other systems do special studies once a year or once every 3 years, 5 years, or even 10 years. The structure of the data collected in the current studies also varies from study to study. This is due to differences in the level of detail and in the mixture of the elements within categories. Figure 2.2 summarizes all of the studies reviewed by the author into a common format. Summarizing in a common format is a difficult task because of the differences in terminology used and the differences in the way activities are grouped.

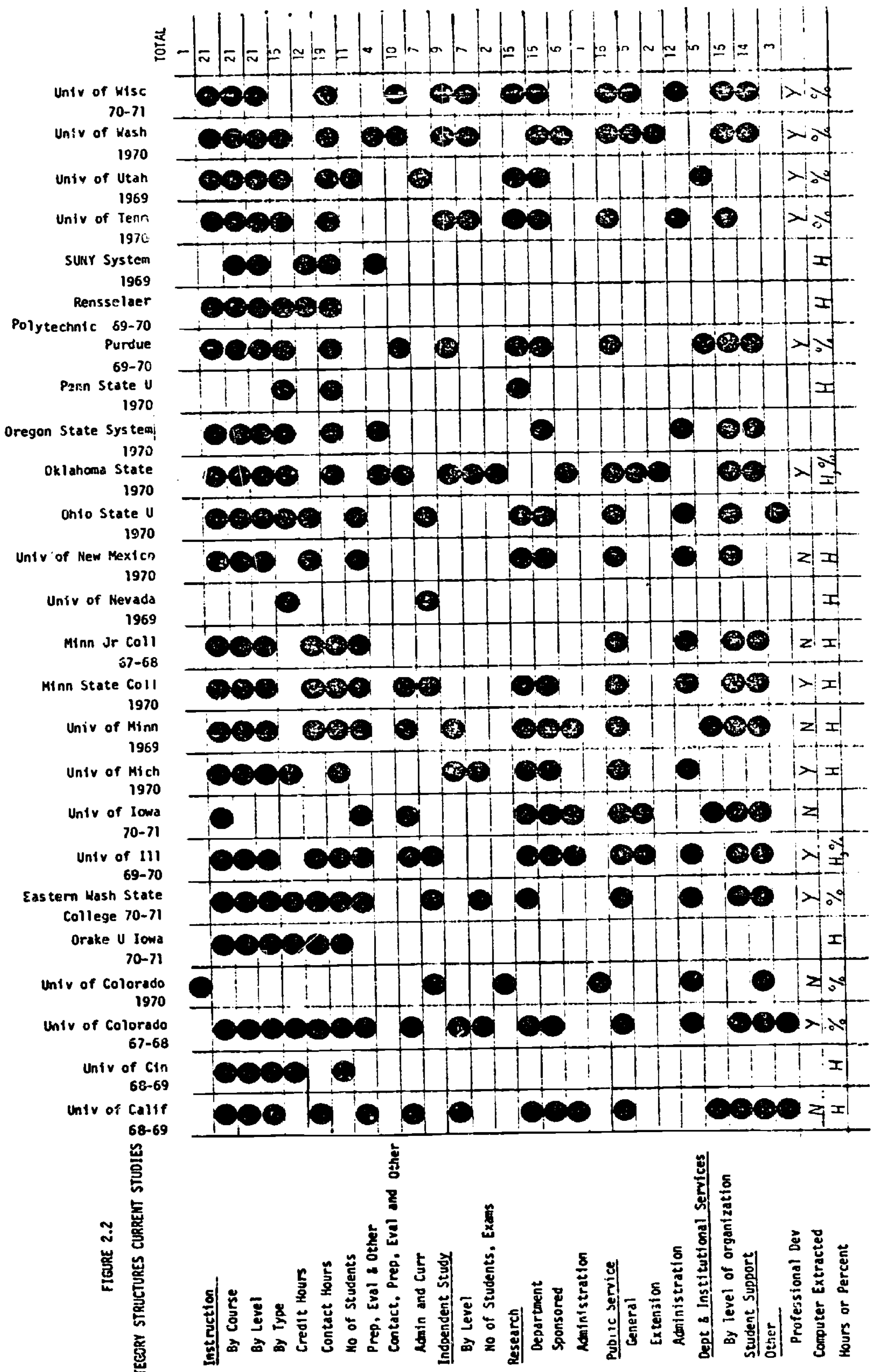


FIGURE 2.2

CATEGORY STRUCTURES CURRENT STUDIES

A significant difference between the current studies and the past studies in category structure is the greater emphasis on detail in the current studies. Most of the current studies break instruction into detail by course, by level of instruction and by type of instruction. More emphasis is given to independent study by level of student, especially in the graduate institutions. Research is segmented by department research and sponsored research in almost every study where research is significant. Public service and administration is also broken into detail elements depending on the particular study. It was noted in some institutions (Oklahoma State and the University of Washington) that administration was considered as a part of each of the other categories and not as a separate category. The University of California has an extensive breakdown with a number of major categories. Post doctoral fellows, special examination of students and department colloquiem are major categories that are not traditionally a part of other systems. California breaks out Faculty Senate Affairs, Non-Budgeted Administration, and Budgeted Administration as major categories. The University of Michigan has the least detail of the institutions that pick up data on non-teaching activities. The only detail required is a breakdown of research and creative activity into sponsored versus departmental. Otherwise the University of Michigan covers only the five common major activities. These are (1) Instruction (Regular), (2) Instruction (Independent Study), (3) Administration, (4) Public

Service and (5) Research and Scholarly Activity. The other institutions follow this same pattern for the major categories with one exception. Student advising, counseling and support is generally separated out as another major category.

There are fewer and fewer institutions that are doing studies only on credit hours, contact hours and numbers of students. Drake, Rennsselaer, Penn State, University of Cinncinati and the University of Nevada were the only institutions falling into this category of the twenty-five reviewed by the author. More studies are recognizing the need to collect data on many of the other activities worked on by faculty. It is interesting to note in Figure 2.2 the number of systems that are tied to computer output. This means that the form sent to the faculty to collect data already has some data on it. Typically this data includes the courses he is teaching, the contact hours, credit hours, number of students, and the account numbers he is assigned to for administrative tasks and research projects. The faculty member makes changes where appropriate and adds the additional data such as hours or percent of time.

THE WICHE EFFORT

The WICHE MIS program is currently facing the problem of defining what faculty do and how to measure it. Huff and Farmer wrote a paper in 1969 entitled the "Components of the Instructional Function in Higher Education" in which they list nine faculty activities [Huff and Farmer, 1969].

1) Formal classroom, laboratory and tutorial contact

with students, including preparation for such contacts and subsequent evaluation of student work.

2) Formal supervision of research and thesis work (conducted under a course number).

3) Conduct of experimental or innovative instructional programs.

4) Informal seminars and conference contact with students.

5) Academic advising of students.

6) Development of new or innovative instructional materials or approaches for future use with students.

7) Participation on academic committees.

8) Departmental research, financed internally for the primary purpose of maintaining or improving the professional competance of faculty and for the benefit of those students who may be involved.

9) Participation in meetings and activities intended to produce professional growth.

The paper also sets up a two dimensional array for structuring these nine activities into four different types as they pertain to instruction.

Direct Instruction	Indirect Instruction
Type I	Type II
Formal Classroom Contact and related preparation Formal supervision of research and thesis work Innovative Instructional programs	Development of new innovative instructional materials or approaches for future use Academic Committees
Type III	Type IV
Informal seminar and conference Contact with students Academic Advising of students	Department Research Faculty Participation in professional meetings and activities

Early in 1970 a task force suggested that an ad hoc group be set up to consider the problems in faculty activity analysis. The task force recommended that the Faculty Activity Analysis Ad Hoc group consider the following questions [WICHE, 1970].

1. What is the degree of institutional interest in studying faculty effort and output?
2. In what manner should total faculty efforts and outputs be surveyed?
3. What are the possibilities of developing and gaining acceptance of a WICHE MIS standard faculty activity analysis instrument?
4. Can a standard faculty activity analysis procedure be used by homogeneous groups of institutions?
5. What are the possibilities of using the products of a faculty activity analysis survey for comparative purpose?
6. Should the staff expand the concepts presented in the paper, "Faculty Activities Contributing to the Instructional Function of Higher Education", in order to explain the problems of determining higher education joint products and their relationship to the analysis of faculty activities?

A draft submitted by this task force in June 1970 highlighted some of the factors which account for the difficulties that deal with the problem of analyzing faculty activities [Andrew, Curry, Romney, 1970: 1]. The problems cited were as follows:

1) The lack of a common set of definitions of faculty activities.
2) The lack of ". . . common guidelines for the assignment of specific activities among the processes of instruction" [Inter-University Council of Ohio, 1970: 48].
3) Lack of uniform methods for measuring the amounts of time and/or effort spent in these activities.
4) Lack of differentiated levels of data (for different management levels) on faculty activities and cost allocations.

The task force draft as of June 2, 1970, outlined the following objectives of their project [Andrew, Curry, Romney, 1970: 3].

1. Construct a set of definitions of faculty assignments which are as mutually exclusive and exhaustive as possible.

2. Develop a system which will facilitate classifying these faculty assignments according to the programs of the institution.
3. Suggest a process for improving faculty assignments and for measuring effort devoted to the activities associated with each assignment.
4. Develop a procedure for the allocation of faculty costs to programs.

A preliminary draft of a paper resulting from this project was released for review about April 1, 1971 [Romney, 1971]. This paper discusses the importance of relating the activity vector with the program vector when gathering data on faculty. A general activity/program matrix is described where the activity dimension is along one axis and the program dimension is along another. The activity dimension is defined as follows:

1. Teaching Activities
   1.1 Course Activities
   1.2 Course Related Activities
   1.3 Other Teaching Activities
2. Student Service Activities
3. Research and Creative Works Activities
4. Professional Service Activities
5. Administrative Activities
6. Other Research and Creative Works Activities
7. Other Professional Activities
8. Other Activities

The paper discusses two major breakdowns of the activities vector.

1. Activities which have direct program implications and affects, and for which the institution pays the faculty member.
2. Activities which are not paid for by the institution and in which faculty engage regardless of their assignments.

Which activities are put in the last category is an institutional decision. Activities such as (a) Other Research and Creative Works Activities, (b) Other Professional Activities and (c) Other Activities are possible candidates for the last category.

The program dimension of the activity program matrix consists of the programs defined in the Program Classification Structure (PCS) [Gulko, 1970]. The major program classifications are (1) Instruction, (2) Organized Research, (3) Public Service, (4) Academic Support, (5) Student Support, (6) Institutional Support, (7) Independent Operations. Each cell of the program activity matrix would contain weekly hours spent in activity mode (i) attributed (by faculty) to program (j). When each cell of the program/activity matrix is filled, one can easily sum the matrix to obtain the total time expended per activity or per program.

FACULTY ACTIVITY MEASUREMENT AND DATA COLLECTION

MEASURE OF FACULTY ACTIVITY

Measures of faculty activity fall into two classes. (1) Measurement of teaching activity alone such as (a) credit hours, (b) contact hours, (c) student credit hours; and (2) Measurement of all activity including non-teaching activities. The measurement of faculty activity in terms of credit hours or contact hours assumes that all the activities of the faculty member are primarily teaching or correlated very highly with the teaching function. It also assumes that three credits of course A is equivalent to three credits of course B, since in most studies they will be added together to come up with a total measurement of activity or load.

> The credit hour - semester or quarter - is undoubtedly the most common measure of faculty load in institutions of higher education. It is usually presumed that there is a somewhat constant ratio between credit hour load and total faculty load and that, therefore, credit hour load gives a rather reliable index to total faculty load [Stickler, 1960: 81].

Various studies have shown that credit hours are not a good measure. Knowles and White [Knowles and White, 1939: 809] indicated in their study that credit hours do not reliably reflect instructional load. Their study showed total time per credit hour varying from 2.9 to 5.5 hours. Other studies show similar variances. Stewart in a 1934 study [Stewart, 1934: p. 225] showed a range from 2.2 to 7.7 hours per credit hour. A 1937 study by Michell [Michell, 1937: 311-19] indicated that a fifteen hour credit load usually requires about 50 hours per week,

but that it could go as high as 84 hours. Another study [Woodburne, 1958: 93-96] uses four hours per credit hour as a measure. A recent Ohio study summed it up this way.

> Clearly the conclusion of virtually all studies from 1929 to 1959 was that neither credit hour, contact hour, student credit hours or student contact hours were by themselves, or together, reliable indicators of faculty members' workloads.
>
> Despite the results of these studies, the convenient descriptive load of fifteen credit hours per week (with an average of two hours preparation and grading for each credit hour taught), has persisted throughout higher education. Two reasons account for this persistence. First, the fifteen hour load presents a simple description of a complex phenomenon. By adding preparation time one arrives at a work week of forty five hours, which seems intuitively sound. (In this case, the evidence of actual studies shows a forty-five hour week to be conservative estimate of a typical week.) Second, no better substitute measure was available. Junior Colleges were pleased when they could, from registrars' records, show a fifteen hour load. Universities argued that twelve was a better number when research and public service were considered. The American Association of University Professors recently recommended that nine be adopted as being more realistic. In short, the use of the "credit hour" as a standard criterion for evaluating an individual's contribution to the work of his university is even less appropriate then it was ten years ago and it was clearly inappropriate then [Inter-University Council of Ohio, 1970: 7-8].

It is not difficult to argue that credit hours is a poor measure of teaching activity. When one considers the percentage of time spent by faculty on research, public service and administration, it is easy to see why activities related to credit hours are not the only significant time consuming items. The correlation, of course, varies by type of institution (Junior College, State College, University).

An alternative to measuring activity in terms of credit hours or

contact hours is to measure faculty activities by clock hours. Although credit hours are still used as a guideline to measure teaching load, more and more institutions are collecting data in the form of clock hours or percent of total time to measure total effort. The advantage of this approach is that it does a better job of including all activities of the faculty. Also, it does not make the assumption that the effort to teach three credits of course A is the same as the effort to teach three credits of course B.

The question of whether one should gather data in terms of hours or percent of time is a difficult one. If one gathers data in hours, then percent of time can be derived. The reverse is not true unless one gathers, in addition, some information on average total hours per period. Because of the fact that there are large variations in the work week, percent of time alone is not very meaningful. The usefulness of percent reporting depends on how the information will be used. For costing purposes, it can present problems. Tyndall and Barnes give a good explanation of the problem in reference to the CAL-Big Ten study [California and Western Conference Cost and Statistical Study, 1960] where faculty workload was computed on a percentage basis. They cite that

> this approach has obvious merits, but given the wide range in the number of working hours per week reported by faculty members, it has one major disadvantage that can be illustrated best by a single example: If two faculty members teach separate sections of a single course, each having the same salary and spending nine hours each week in contact with students and in "preparation" for class (including the grading of

> exan... ...urse assignments, office hours, etc.), but one states that he spends 25 percent of his (36 ho... ...ork week on teaching whereas the other spends 16 2/3 percent of his (54 hour) work week on teaching, quite different amounts will be charged to instruction in the two cases by the percentage-of-time approach. This seems clearly unreasonable. To say that teaching costs more in the case of the man with the 36 hour work week because he does less research would indeed be strange; the same cost should ... charged in each case [Tyndall and Barnes, 1962: ...].

The problem of the cost varying just because the hours vary from professor to professor is particularly difficult to accept when one considers that the number of hours are almost completely under the control of the professor. Another complicating problem is the group of activities that are counted when one considers faculty activity measurement. Should the cost of a course go down because a particular faculty member (a) does more public service, (b) does more professional reading or (c) engages in more student support? Further, should a cost of a course in one quarter be lower than the cost for the same course in another quarter just because other non-teaching activities vary from quarter to quarter? These questions have not been answered.

FACULTY ACTIVITY DATA COLLECTION

SURVEYS: One of the most significant problems in working with faculty activity analysis is a system to collect the data. Various methods have been experimented with, but the predominant method in use is the questionnaire. The usual approach is to distribute the questionnaire after the quarter has ended, and ask the professor to estimate the time spent in each category

of activi... ... ...ted before in this chapter, the estimates can be eit... ... of hours or percent of total time.

The format of the form is important. Like any questionnaire it should be adequate to provide the data needed and yet simple enough so that it can be understood. John Stecklein, who has done conside... work on faculty load research, makes the following suggestions.

> It is essential that each faculty member feel that the report form gives him ample opportunity to describe accurately the kinds of activities that he performed during the period under study. Planning such a form is difficult because the more provisions made for distinctive responses, the more difficult is the analysis and, usually, the longer the form. Some compromise has to be reached that will give each faculty member the opportunity to express adequately how he has spent his time and, at the same time, preserve the simplicity of data tabulation and analysis that is desirable [Stecklein, 1961: 14].

Stecklein goes on to suggest that a form of three to four 8 1/2 x 11 pages should be adequate for the faculty member to sufficiently include everything. If the form is less than this, he feels that certain faculty activities may be neglected and the study will no longer be a comprehensive analysis of faculty load, or activities may be grouped together in such a way that the forms will not adequately differentiate faculty functions.

Generally the reporting is for some period such as a quarter or a semester. Some studies ask for data for each period over the entire year. The University of Colorado form for 1968 requested data for the entire year [McMichael, 1968]. The problem with obtaining estimates over such long time periods is that it is

difficult to remember what has transpired, in terms of activity and the amount of time spent. Consequently, the reliability of this data for planning purposes and for models has been doubtful. There has been only one published study known by the author that has investigated the problem of estimates versus actual. This was a study done by Ritchey at Purdue in 1959 [Ritchey, 1959b: 244]. Ritchey stated that in general the correlations between actual and perceived activity were only fair. The most accurate estimates were made of the time spent in class. This would be expected. The least accurate was the time spent in personal activity during regular hours. "Without exception the faculty estimated their time spent on personal activity to be much less than the percentage actually observed. The most accurate estimate made by an individual was three percentage points lower than the observed value of 20%" [Ritchey 1959: 248].

Stecklein tends to support estimates as being fairly accurate. He states that estimates have agreed favorably with diary records and that any system will be in error by at least 5 percent [Stecklein 1961: 17].

The author has had various conversations with department heads and faculty and the general consensus is that estimates are useless except for general information. With this feeling prevailing, the amount of effort that goes into these estimates probably is a big factor in why they are potentially very inaccurate.

There are various ways to control the input of the data which might help the accuracy of estimates. The estimates could be routed through the department head for review. This gives the department head the opportunity to review and to discuss with his faculty any glaring discrepancies. The discrepancies may be due to oversights, misunderstanding of the form, or over-zealous estimating. This procedure exercises some control and adds to the consistency of the data.

> Department heads who have participated in such a procedure have expressed genuine appreciation for the opportunity, and the experience has caused many to investigate discrepancies between their impression of what a faculty member was doing and the individual faculty member's report of what he was doing [Stecklein, 1961: 25].

DIARY: There have been small diary studies done occasionally in departments and by individual faculty members who are interested in finding out how they are allocating their time. Probably the most extensive study done using the diary method was recently completed in England under the Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom. The author corresponded with the Secretary of the committee, A. A. Bath and received a copy of the diary and information describing the study. A copy of the diary and notes for guiding the organization of the enquiry are shown in Appendix I. The study was conducted in 1969-70. As of March 22, 1971, the results were not ready for publication.

The diary was given to the faculty to maintain for a period of a week. There were three diaries filled out over the entire year by a

faculty me[illegible] was for a normal teaching week (in the first term), anot[illegible] for a week in vacation but falling outside a personal holiday period and the last one for a week falling within an examining period. The study covered a sample except for some universities that agreed to a full census. The selection of faculty was stratified by department. A systematic sample used a random number to set the starting point on a list of names. Every third name was used in the sample.

The diary, as shown in Appendix I, was set up from 8:00 a.m. to midnight. The faculty member had to categorize each half hour of the day into one of seven categories. The categories were as follows:

A. Undergraduate Time

B. Graduate Course Work Time

C. Graduate Research Time

E. Unallocable Internal Time

F. External Professional Time

G. Private and Free Time

There was also a space to record faculty activity done between the hours of 12:00 a.m. and 8:00 p.m.

The reactions by some of Britian's 30,000 staff members to this inquiry were reported in a recent article in <u>Science</u> [British Dons', 1969: 1489].

> Many have reacted like clerics asked to prove their piety, generals their patriotism, or dowagers their virtue. Proclaimed a Cantabrigian in a letter to the <u>Times</u> "the only proper reaction, surely, is to march upon the originators of the scheme and make

> them eat their rediculous phamphlets--the only way of ensuring that the results of the enquiry will be properly digested." Another letter from a professor's wife: "At times my husband talks in his sleep about academic or university business. Do I the next morning, after timing the duration of these remarks, advise him to transfer these periods of dormitory cogitation from 'private and free time' to another category?".

An explanatory letter from the Committee of Vice Chancellors accompanying the diaries carried the suggestion that the committee acted to head off what might have been a less sympathetic inquiry by another body, the University Grants Committee, the quasi-officer body responsible for channeling funds to higher education.

SAMPLING: The most recent study to use sampling extensively in collecting data on faculty is the University of California study. Out of a total of 5813 FTE* faculty a sample size of 681 was set. This is based on a sample size of ten percent per college with the exception of some of the smaller schools where the sample population was increased. The sampling was limited to around 600 due to the feasibility of using the interview method to collect the data. A systematic sample selected a random number between one and ten and every tenth serial number starting at that random number was used in the sample. A six digit coding system was used to identify the faculty member.

<u>First Digit</u>: Identifies the campus. The codes are 1-9 and their correspondence with the campuses is the one shown on page 8 as well as in Table 1, etc.

*FTE = Full Time Equivalent

<u>Second and Third Digits:</u> Identify the "subject field" within each campus.

<u>Fourth Digit:</u> Identifies the "rank" of the sampling unit.

<u>Fifth and Sixth Digits:</u> Identify the individual faculty member selected for the sample, within "rank" within "subject field" for each campus (stratum) [Athanasopoulos, 1968: 30].

With this sample design the following analysis could be done.

a. <u>Total Population</u> (all campuses, all subject fields, all ranks together).

b. <u>Separate Campuses</u> (within each campus all fields and all ranks together).

c. <u>Separate Subject Fields</u> (by combining either all campuses, or at least the small campuses, and in any case all the ranks. This type of analysis should not, however, be attempted for fields with <u>too few</u> cases).

d. <u>Separate Ranks</u> (combining all campuses, or at least the small campuses, as well as all subject fields. Again, analysis of too few cases, such as "Associates", should be avoided).

e. <u>Subject Fields Within Each Campus, Ranks Within Each Campus, Ranks Within Each Subject Fields, and finally, Ranks Within Subject Field Within Each Campus</u> (These types of analyses should be made with extreme caution and only for very few cases where the sample size is not too small([Athanasopoulos, 1968: 31-32].

Another sampling method that has been experimented with uses a work-sampling approach. The only study known by the author, using this technique with a group of faculty in higher education is a study by Ritchey at Purdue in 1959. The results of the study have been published in two articles entitled "Utilization of Engineering Faculty Time" [Ritchey, 1959b: 244] and "An Unusual Work Sampling Application" [Ritchey, 1959a: 450].

Ritchey set up eighteen activities under five general categories.

A. Teaching
   1. In class
   2. Course preparation
   3. Course followup (alone) i.e., grading papers
   4. Course followup (with other) i.e., discussing with students

B. Research
   1. Individual (alone at desk)
   2. Group discussion i.e., discussing research problems with others
   3. Experimental (in laboratory)

C. Administration
   1. General (alone)
   2. Group discussion
   3. Supervision
   4. Meetings formal
   5. Student Counseling

D. Miscellaneous
   1. Entertaining off-campus visitors
   2. Attending meetings off campus
   3. Working on consulting job
   4. Visiting plant
   5. Engaging in activity for personal development

E. Personal Activity

The design of the study was structured over a 44 hour week (8:00 a.m. to 5:00 p.m. Monday through Friday and 8:00 a.m. to 12:00 p.m. on Saturday). The number of observations per day was determined on the basis of how often one could bother the professor, rather than on the basis of determining the accuracy required and deriving "N" using the formula for the standard deviation of the binominal [See Chapter 3]. The intuitive number that was derived was 4 times per day. The study was coordinated with 20 faculty members over a 16 week semester. At four observations per day and two on Saturday, there were 7,040 possible observations. After taking off 440 for testing observation effects and losing 29 points, the study ended up with 6,571 observations.

Other time spent on faculty activities (evening and weekend activity) not covered in the hours sampled was covered by selecting 20 days at random for each of the faculty members and obtaining from them a full report of their after hour faculty activities.

The faculty did not know ahead of time which day they would be sampled. Picking up the data on after hours activity depended upon recall, however the professor was contacted on the following day in most cases to minimize the forgetting. The author contacted Dr. Ritchey to obtain information on problems he had with the study. Since he was in Saudi Arabia at the time, he did not have access to his study and could not accurately recall the problems he had. He did make this statement in his letter.

> I do recall that one of the points of concern was honesty on the part of the participants. I don't mean participants would be dishonest, although this could have happened too, but I am referring to the fact that at the time of contact, the faculty member might be in the process generally of grading papers, but at the particular instant he may be discussing last night's basketball game with his office mate. My feeling, of course, was that this was to be considered personal time rather than paper grading. The faculty member wouldn't always agree with me.

Dr. Ritchey highlighted a few other problems in his article [Ritchey, 1959a: 453]. There were some problems with handling the fact that the categories of activity were not mutually exclusive. Ritchey states that "Although this did present an occasional conflict, each observation was noted under the heading that appeared to be the primary motivation."

Other problems involved interpreting the category definitions.

Research, for the purposes of this study, was defined

> as assigned research and therefore did not include any research carried on independently by a faculty member, or research of graduate students which the faculty member supervises. The two latter types of research were classed as personal development, and student counseling respectively. It was noted that many staff persons use the word "research" in a very general sense; so that it was necessary to give special attention to this problem of classification [Ritchey, 1959a: 453].

Another problem area was how to handle consulting. Dr Ritchey stated that

> to some staff members consulting described any activity they were paid for doing outside the university, regardless of its nature. To be classified as consulting for the purpose of this study however, the outside work had to require the professional abilities of the subject. Other activities for which pay might be received were considered to be hobbies or otherwise non-professional in nature, and therefore were classified as personal activity in the study.

Ritchey stated that there was a desire on the part of some faculty to want to indicate at the beginning of the day what they were going to do that entire day and not be bothered with the observer.

> This of course could not be done, but the situation did require considerable tact in following up on observations as well as further education of the subject into the true nature of the study. Incidents of this nature decreased during the semester which indicated better understanding on the subject's part [Ritchey, 1959a: 454].

Dr. Ritchey indicated that his study was a pioneering procedure intended to present "food for thought" to others who may contemplate making studies of a similar nature. He offered the following suggestions.

1. More attention should be given in advance to the use made of the results. In other words, a study made in order to benefit and improve the operation of an academic department should be designed with that goal in mind rather than designed merely for

the purpose of finding out what people are actually doing with their time.

2. An admitted weakness of the study was having to return to a faculty member when he could not be found to have him recall what he was doing at the time he was to be sampled. The use of recall was a more serious drawback when used with staff members who performed largely administrative duties than with those who performed largely teaching duties.

3. Recognition of the fact that teachers perform a considerable portion of their work outside the normal class or office hours should definitely be included in any future study of university faculty [Ritchey, 1959a: 454].

Ritchey contends that the work sampling technique is a relatively easy, inexpensive and accurate method of discovering activity patterns of a faculty, providing that the full cooperation and understanding of the faculty can be achieved.

FACULTY INFORMATION SYSTEMS

More and more institutions are incorporating faculty activity sub-systems into their operational data systems. These systems take on various forms. Some systems pertain only to course data such as credit loads, contact hours, and number of students. These reports typically multiply credits and contact hours by students to obtain total student credit hours and student contact hours by faculty members, department and college. The input generally comes off of current files without any interaction with the faculty.

This procedure has not always been very satisfactory because often the computer system is not up to date. Changes are made at the department level without bothering to send a change notice to the

deans office for entry into the computer system. Consequently, these reports have to be routed back to the department heads for review before final runs can be made.

Many systems print out a document called a "turnaround" document. The information that is filed in the computer is printed on the document. The documents are sent to the faculty members for additions and corrections. If information is picked up on non-teaching duties, it is also filled out on this document. Appendix L shows some examples of documents used in these types of systems.

Appendix D discusses a faculty information system as a part of an integrated information system.

USES OF FACULTY ACTIVITY DATA

GENERAL INTERNAL ANALYSIS

Traditionally faculty load studies have been used to support questions on a general basis like "What do faculty do?" or "How do faculty in your institution allocate their time?" These questions have been asked by legislatures and coordinating bodies. Consequently faculty have been asked to provide this data to support funding requests. More and more department heads, division heads, deans and vice-presidents in charge of planning are becoming interested in the data for internal analysis and planning.

> Most faculty load studies are initiated by some member of the administration, with some administrative use contemplated. Administrators find faculty load data useful in many ways, including the following: in identifying inequities in faculty load; in obtaining guide lines for the assignment of faculty loads to new staff members; in learning what activities, other than instruction, consume large amounts of faculty time; indirectly, in recommending promotions or salary increases; or in deciding whether to support or reject requests for increases in staff or increases in curriculum offerings [Stecklein, 1961: 35].

Doi also supports the use of faculty activity data for assisting the management of resources internally. He states that we all know that accrediting agencies and legislative committees from time to time express interest in various kinds of faculty load data, but that such data also has value for the institution in arriving at a more complete understanding of its organizations and problems. Doi goes on to list five general areas where the data can be useful.

1) Such information assists administrative officers and faculty groups in assessing the general efficiency and economy of instructional programs.
2) Faculty load studies assist in the development of objective criteria for determining instructional loads and staffing needs.
3) Faculty load data can be used to stimulate experimentation with instructional techniques and various class sizes.
4) The data can be useful for the planning of future expansion and changes in instructional programs. The institutions should be able to detect shifts in student interests and in the emphasis that faculty members might give to various subjects, including changes in level of courses taught by senior and junior members of the staff.
5) Faculty load studies can be used for determining the allocation of funds. The data is essential for identifying those departments that have the greatest use for additional staff members [Doi, 1960: 40].

any of the articles written on measuring faculty work load have een written by deans who are concerned about the problem of llocating resources. Dean Hill, Head of the College of Physical nd Engineering Sciences at Brigham Young University, in a recent rticle on measuring faculty work load stated:

> One of the most difficult tasks of a dean is to create a suitable environment in which his faculty can function effectively. One of the most important factors in such an environment is the faculty work load. If it is too heavy, the faculty member becomes a drudge who lacks initiative and produces poorly. If it is too light, he lacks challenge, has no incentive, and underproduces. If the work load is just right, he is a happy man, with good spirit and good production.
>
> Here lies the dean's challenge. Good measures are the first step toward assessing the work load, and these must be translated into terms the university administration can understand and accept. It is also often necessary to persuade a faculty member--especially a chairman--that his load is a proper one when he does not feel it is [Hill, 1969: 92].

Lewis Cannell, Dean of the Division of Liberal Arts at Clark

College uses faculty load data for checking inequalities, detecting trends, guiding shifts in assignment, guiding refinements in the time schedule, guiding changes in the number of sections of various courses and the number of staff members for the following year, and measures of educational output with which to support budget requests [Cannell, 1959: 3].

George Hauck, who is head of the Department of Civil Engineering at Tri-State College recently wrote an article on estimating Faculty Work Load [Hauck, 1969: 117]. Hauck stated in his article that the "assignment of teaching loads is susceptible to inaccuracies. Many discrepancies exist in terms of preparation time and contact hours. The time consumed by duties not directly related to course assignments is often given inadequate attention. Demands on various members of the staff may differ substantially." Another recent article by Patten, head of the Accounting Department at Virginia Polytechnic Institute, and Beams, Assistant professor in the same department, states that

> One of the most perplexing tasks confronting the academic administrator is that of dividing the teaching load among faculty members. Such misunderstanding has often left administrators open to the charge of favoritism and has led to interfaculty dissention [Patton and Beams, 1969: 1].

The preliminary draft on faculty activity analysis by Romney states that

> Faculty activity analysis, in conjunction with analysis of other institutional resources is a useful and necessary ingredient to the following management functions:
>
> 1. The Long Range Planning Function
> 2. The Program Review and Evaluation Function
> 3. The Budgeting Function

4. The Resource utilization Analysis Function

> The nature of the relationships between faculty activity analysis and these management functions define the purposes for which surveys on the use of faculty resources should be conducted [Romney, 1971].

INTERINSTITUTIONAL ANALYSIS: Coordinating bodies such as State College Boards and Junior College Boards are concerned about allocation of resources to the various colleges. According to Dr. Fred J. Kelly, agencies which coordinate a system must (1) determine which programs and services are to be provided, (2) determine in which institution or institutions each of the programs and services will be supported, (3) fix the amount of operating and capital funds that are to go to each of the institutions, (4) make policies under which the system is to operate, and (5) make provisions for the supervision of the institutions to make sure they are providing approved programs at an appropriate level of quality in accordance with prescribed policies [Bunnell, 1960: 46]. Myron Blee goes on to state

> While coordinating decisions requires something more than faculty work load data, it is true, nonetheless, that faculty work load data assembled in some manner or other are essential to the making of those decisions. If we should fail to devise suitable measures of faculty effort, the continued use of crude measures will be necessary [Bunnell, 1960: 46].

Caution must be exercised when using faculty activity data for inter-institutional comparisons. If the data is not collected with the same definitions and by the same categories, the data will be difficult to compare. One must also keep in mind the objectives of the different institutions so that differences can be interpreted in light of the objectives. Definitions and

measurement criteria must be adaptable to each institution so the system does not break down when there is heavier emphasis on some activities as opposed to others.

FORMULAS AND LOAD LEVELING: Much of the literature in the past ten years has dealt with the development of formulas to aid in measuring faculty load. Many of the current articles, two recent master's thesis and one recent Ph.D. dissertation, have concentrated on the use of formulas [See Appendix G].

Some of these studies [Hauck, 1969] [Hill, 1969] [Swanson, 1966] have concentrated primarily on teaching activities as opposed to non-teaching activities. Typical variables included in these formulas are: (1) class time, (2) preparation time, (3) instruction outside of class, (4) number of sections and (5) number of students.

Other studies [Banks, 1963] [Powell, 1967] [Henle, 1967] [Miller, 1968] have developed formulas that include non-teaching activities. Some of these can be very complex. Miller's formula involves 31 components. The non-teaching activities generally included in the formulas include: (1) Committee work, (2) Administration, (3) Student Counseling, (4) Research, (5) Professional development and (6) Public service.

UNIT COSTING: A primary use of faculty activity analysis is to develop a basis for allocating costs of education. Since faculty salaries represent a large proportion [Chapter 1] of the total direct costs, it is important to have a reliable basis for allocating this portion of the total cost to outputs. Most of the

attention to unit costing in higher education has been in the past 10 years. Extensive studies include: (1) California and Western Conference Cost and Statistical Study. (2) Factors Associated with Instruction Costs in Kansas Public Higher Education, a Ph.D. dissertation by Waldo K. Anderson. (3) Differential Costs of Curricula in Comprehensive Junior Colleges by Ernest Anderson of the University of Illinois. (4) Faculty Workload and Unit Costs of Instruction in Minnesota State Junior Colleges, a Ph.D. dissertation at the University of Minnesota by Carl Gerber. (5) Unit Costs of Instruction: A Methodological Approach by Warren Gulko. [See Appendix H for a summary of these studies.]

Unit costs that were derived in some of these studies included: (1) direct salary cost per student credit hour, (2) supportive teaching cost per student credit hour for each course, (3) total cost per student credit hour for each course, and (4) total cost of educating a student in each curriculum offered.

Gulko's study is a methodological study that structures the mathematical relationships between the variables of discipline, course level, direct cost, number of students, total cost, average cost and FTE student.

<u>PROGRAM COSTING</u>: The emphasis on program, planning, budgeting systems has created a significant need for data on faculty activities. Program budgeting and costing requires that faculty effort be known by type of effort, so that the cost of that effort can be allocated to the proper programs. As program structures are set

up for universities, one can see how faculty effort of any individual faculty member can contribute to multiple programs.

Although there is a lot of interest in PPBS in higher education, there are very few studies one can reference as operating examples. Most of the work done has been conceptual, and related to planning models. James Farmer sets up some very generalized examples in his monograph on PPBS [Farmer, 1970: 10]. The data is based on the California State Colleges. One example shows the effects of adding an engineering program in the third year of a five year program for a growing state college. Another example shows the effect of enrollment shifts caused by changes in student demand. The examples presented in Farmer's monograph, however, do not address the problem of allocating non-teaching activities.

Paul Swanson discusses program costing in his Ph.D. dissertation, entitled "Program Budgeting for a College of Business Administration" [Swanson, 1966: 28]. Swanson discusses the problems of allocation. However, he, like Farmer, did not face the problems of non-teaching duties. Swanson assumes the direct labor base for higher education is the full time equivalent class hour.

> As a general operational rule, all costs which are directly related to any specific course are charged to that course as a direct expense while all other costs are allocated on the basis of FTE per course [Swanson, 1966: 30].

Balderston in a memo to President Hitch at the University of California states that unit costs can be used to "estimate the costs of changing the composition of University Programs and enrollment. To obtain unit costs in program terms requires the

definition of a program structure and then the measurement and allocation of costs in that structure" [Balderston, 1970].

Balderston goes on to state that the

> Faculty Effort and Output Study can be used to distribute the whole of the regular faculty departmental wage bill by level of student, making prior correction for the fractions of hours devoted to departmental research and to administration. The option exists of pulling out these components of faculty activity and going to program costing [Balderston, 1970: 6].

PLANNING MODELS

INTRODUCTION

Chapter 1 briefly introduced the concepts of models and the use of them in higher education. As was shown, there are a number of models that have been developed in the past five years. This section will discuss a few specific models and their relationship to faculty activity analysis. The first topic describes input-output analysis. The second topic discusses the Resource Requirements Prediction Model. The final topic discusses the CAMPUS model.

INPUT-OUTPUT ANALYSIS MODELS

Input-output analysis represents another area where work is being done to study the production process in higher education. A recent Ph.D. dissertation by Robert Latham uses an input-output approach to do a comprehensive analysis of production, costs, and optimal mixes in a medical college. Latham describes input-output analysis as follows.

> The medical college is viewed as a firm producing multiple products such as research, patient services, undergraduate medical education, intern and resident education, graduate education, etc. Activities of production are interrelated. Since activities of production are interrelated, a model is needed to capture these structural relations.
>
> Input-output analysis used in this context is a technique which explores the technological production relations among primary inputs and production activities. Resource flows are clearly delineated using this analysis. Input coefficients can be estimated For predictive purposes, primary input requirements

> and required production activity levels can be determined for any set of desired final outputs.
>
> Input-output analysis is used in this study because (1) the medical college produces multiple outputs through many production activities, (2) these production activities are interrelated and (3) input-output analysis captures the structural relations among those production activities. Further, a detail breakdown of primary input requirements necessary for expansion can be determined [Latham, 1971: 24].

In order to obtain the inputs for the extensive analysis done in this study, it was necessary to expend considerable time and effort in obtaining data on how the staff at the medical school spent their time.

> On the basis of effort reports submitted by faculty members and other personnel in 1967-68 and 1968-69, dollar values of resources flows to seventeen programs of the medical college were generated. These extensive data, by individual, class of good, department, and account provided the prime source of data for this study [Latham, 1971: 32].

This data was designed to consider only medical, resident and intern education programs as groups. Consequently further data had to be collected to allocate resources to the specific categories of these programs such as to specific courses or to specific years of resident education. Consequently follow up interviews and effort reports were necessary to collect this additional data. Department chairmen filled out the majority of the additional data required. All data was filled out in terms of percent of total effort.

Categories used were:

1. Undergraduate Medical Education (%)
2. Resident and Intern Education (%)
3. Patient Services (%)

4. Research (%)

Each one of these were broken down further by specific course, level of student, and activity.

Another study using input-output analysis in higher education is the research being done by Dave Cordes in conjunction with the PRIME Project [Cordes, 1971]. Cordes is using an input-output analysis program developed for the Defense Department and applying it to higher education. The approach being taken is to supply the input-output analysis program with data from the CAMPUS model. Data on faculty activities is again crucial since it is a primary input to the CAMPUS model.

Koenig has structured a general format for an input-output table in the higher education environment. This table is shown in Figure 2.3.

> The entries in the table, of course, represent the policies followed in allocating the manpower resources of the department to the identified outputs. Since each member of the academic faculty is a free agent in how he allocates his time to the assigned and unassigned areas of responsibility, the allocation policies must be compiled from information provided by each member of the faculty. In an effort to make this information as reliable as possible, each member of the faculty is asked to register on a card (prepared for that purpose) at the beginning of each term the way he expects to allocate his time to the indicated outputs. At the end of the term each faculty member will be asked to modify this card in accordance with what actually happened and at the same time complete a second card indicating his planned activities for the forthcoming term. In all cases the faculty's response is monitored by the department chairman, with the view that any differences in the conceived allocations would be negotiated through discussion. It is believed that over a relatively short period of time such a procedure will converge to a reliable measuring instrument and one which requires only

FIGURE 2.3

INPUT-OUTPUT TABLE COMPILED FROM FACULTY SURVEY

Total outputs in units indicated		No. Candidates (15)	No. Students (100)	No. Students (340)	Student Credit Hours (82)	Student Credit Hours (332)	Student Credit Hours (22[illegible])	Student Credit Hours (0)	Course Credits (10)	F.T.E. Profs. (3.34)	F.T.E. Profs. (0.64)	F.T.E. Profs. (1.0)	F.T.E. Profs. (0.37)	F.T.E. Profs. (0.40)	F.T.E. Profs. (1.38)	F.T.E. Profs. (0.62)	F.T.E. Profs. (0.09)	F.T.E. Profs. (0.60)
Total Inputs in F.T.E.	Output / Input	Thesis Direction	Graduate Counseling	Undergrad. Counseling	900 Level Instruction	800 Level Instruction	300 & 400 Level	100 & 200 Level	Course Development	Contract Research	Dept. Spon. Research	Consultation & Reviews	Lectures & Seminars	Proposal Prep.	Dept. Management	College Management	University Management	Professional Development
6	Professor	0.70	0.17	0.05	0.20	0.95	1.4[illegible]		0.28	1.05		0.1	0.20	0.25	.80	0.20	.05	0.18
7	Assoc. Prof.	0.27	0.16	0.06	0.50	0.95	2.40		0.35	1.09	0.50	0.8	0.12	0.10	0.31	0.37	0.04	0.12
6	Assist. Prof.	0.40	0.14		0.13	0.60	2.15		0.41	1.20	0.14	0.1	0.05	0.05	0.27	0.05		0.30
0	Instructor																	
20	Grad. Asst.						8.0			12.0								
	Undergrad. Asst.																	
3	Technician					0.5	2.0			0.5								
4	Secretary		0.2	1.0	0.2	0.2	1.0			0.2	0.2		0.1	0.1	0.8			
	Hourly Labor																	
	Other			1.0														
	Column Total	1.37	0.67	1.11	1.03	3.2	16.9		1.04		0.84	0.29	0.47	0.5	2.18	0.62	0.09	0.60

COEFFICIENTS IN THE TABLE REPRESENT TOTAL FULL-TIME EQUIVALENTS (FTE) OF MANPOWER BY RANK OR JOB CLASSIFICATION DEVOTED TO EACH CATEGORY OF OUTPUT.

[Koenig, 1969: 29]

fifteen or thirty minutes for each member of the faculty to complete [Koenig, 1969: 36].

THE RESOURCE REQUIREMENTS PREDICTION MODEL

RRPM (Resource Requirements Prediction Model)* is more aggregate than the CAMPUS model. It does not go down to the course level in detail. Courses are grouped into lower division, upper division, upper graduate, graduate and other per discipline. Consequently, there are actually five courses per discipline. A discipline could be a department or a division or any grouping desired. Parameters are put into the model in more aggregate form. These include (a) ratio of credit hours to contact hours, (b) average section size, (c) average faculty load, (d) distribution of faculty by rank, and (e) a faculty salary schedule. The diagram in Figure 2.4 shows a flow of the segment of the RRPM model using these parameters.

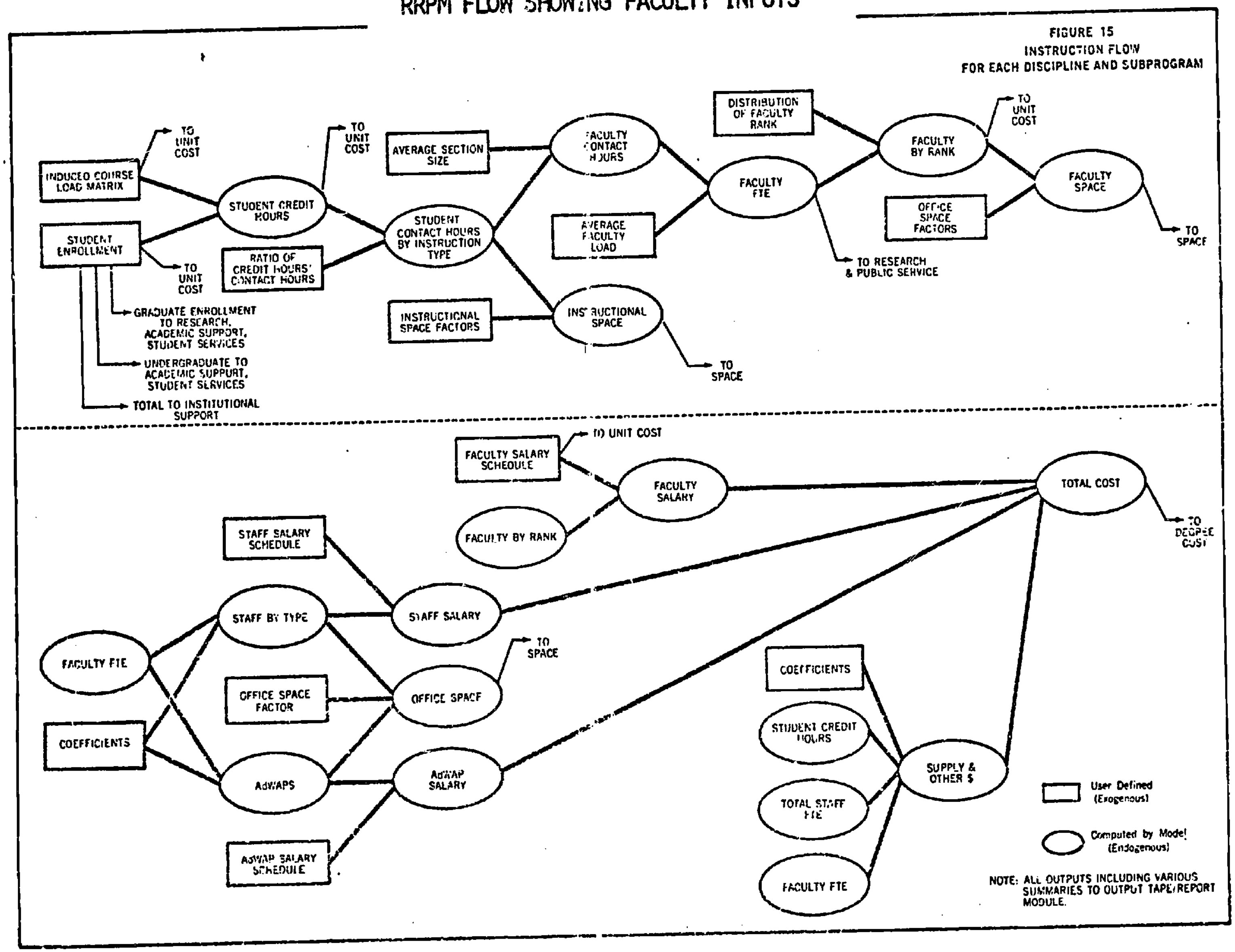
The present RRPM model ($RRPM_1$) does not have either a student flow module or a faculty flow module. Tentative plans are to include a student flow module by June, 1972 and a faculty flow module by the beginning of 1974.

THE CAMPUS MODEL

INTRODUCTION: The CAMPUS model is the most detailed of all the models developed [Weathersby and Weinstein, 1970: 14]. The detail goes down to the course level such that each course

*RRPM is a simulation model presently being worked on and supported by WICHE.

FIGURE 2.4
RRPM FLOW SHOWING FACULTY INPUTS



specifies the type of resources needed to teach it. Faculty parameters are a key input to the model. Before going into an explanation of the faculty modules and their data needs, a brief description of the overall flow of the model will be helpful. For a more detailed explanation of the model flow, reference the reports from Project PRIME.*

CAMPUS programmed in Fortran is structured into about 25 subroutines or modules. The model was programmed initially for an IBM 360-85 with 512K of core. It went through various iterations of development. The version that was finally released for public use was labeled as CAMPUS V. The CAMPUS V model was later developed into CAMPUS-Connect, by the Systems Research Group** in Toronto for use in junior colleges in Ontario. Project PRIME converted the CAMPUS V model from the IBM 360 version to a CDC 6600 version with a configuration of 65K words internal core and 256K words extended core. After the conversion effort, various modifications were made to the model by Project PRIME to improve the outputs of the model.

INPUT: The input to the model is grouped into ten different types. The types are (1) DEFINE, (2) ACTIVITY, (3) PROGRAM, (4) STUDENT, (5) STAFF and XSTAFF, (6) SPACE and AVLSPACE, (7) SERVICE, (8) EQUIPMEN, (9) REVENUE, (10) MISCELLA. All inputs are read into into the model at the beginning of its execution. A set of

*For an explanation of Project PRIME see Appendix A.

**A private consulting firm in Toronto, Canada.

***K equals 1000.

input data reports that format the input into a convenient form for verification are immediately printed out if requested.

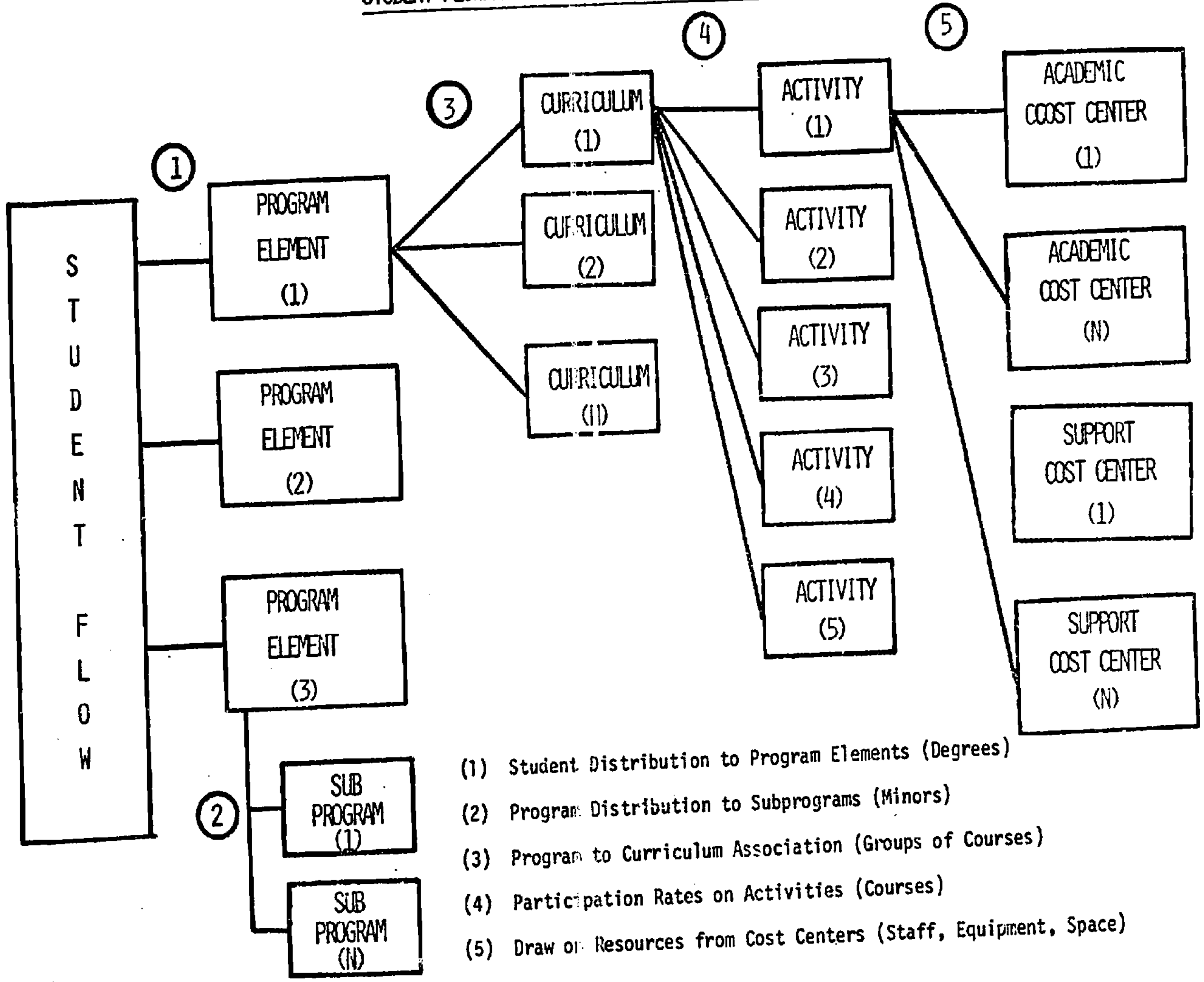
STUDENT FLOW PROCESS: The main processing of CAMPUS is shown in Figure 2.5. Students are put into the model by credit range (class rank) and by program (Degree or degree group). Each program has attached to it a set of curriculum. A curriculum in CAMPUS is a set of courses in a specific quarter (Fall, Winter, Spring) for a particular credit range (freshmen, sophomore, junior, senior) that have some probability of being taken by students in a program that calls out the curriculum. Consequently, a four year program on the quarter system will call out 12 different curriculum (3 per year).

A specific curriculum can be used more than once. If students in three programs take the same courses for the first year, all three programs can call on the same curriculum. The model did not have the capability to put two or more curriculum together for a particular quarter and credit range. For example, curriculum can be set up for majors, minors and a general education core, and the curriculum for a program for a quarter will equal the major curriculum plus the minor curriculum plus the general education core. The CAMPUS-MINNESOTA model has incorporated the ability to handle this. Figure 2.5 illustrates this with the boxes called sub-programs. There are participation rates between the major programs and the sub-programs (note 2).

The courses in CAMPUS are called activities. As students flow into programs, demand is put on curriculum which puts demand on activities

FIGURE 2.5

STUDENT FLOW/ACTIVITY/RESOURCE DEMAND PROCESS



(1) Student Distribution to Program Elements (Degrees)

(2) Program Distribution to Subprograms (Minors)

(3) Program to Curriculum Association (Groups of Courses)

(4) Participation Rates on Activities (Courses)

(5) Draw on Resources from Cost Centers (Staff, Equipment, Space)

through participation rates. As each program is processed, a total demand of students is built up for each activity. Then the number of sections are derived based on section size parameters for that activity (minimum, desired, maximum). Demand on the cost center resources by activity depends on (1) the number of sections the activity was split into, and (2) the resources required per section for that activity. The resources will be faculty time, teaching equipment, and classroom space. Faculty time is the major resource.

OTHER PROCESSES: Another major part of the CAMPUS model is the analysis of space needs. Space is analyzed in terms of contact hours demanded and contact hours available by type and size of classroom. The number of rooms required is derived by type and size and this is compared with the available inventory of space. There are 27 different space reports that one can call for from the model. The remaining sections of the CAMPUS model handle service departments, miscellaneous resources and revenue. Service departments are used to model the resources required to handle computer centers, research centers, libraries, physical service and other support areas. Service centers are tied to cost centers so that a cost center can consist of a number of service centers that will be aggregated into the cost center report.

Miscellaneous resources are used to model fringe benefits of staff, travel funds, supplies, telephone and other miscellaneous line items in the cost center budgets.

Revenue can be put in by cost center or service department. The proportional basis table can also be used to drive revenue. An example would be to put revenue into the cost centers on the basis of student credit hours.

The model summarizes all operating costs by cost center and comes out with two summary operating reports. One report is for the cost center only and the other is for an aggregate for all costs up to and including that cost center. This includes all lower level cost centers as well as service departments.

A new section of the model that is being implemented as a part of Project PRIME involves a complete set of program cost reports [See Ph.D. Dissertation by David Cordes, 1971]. These reports will reflect the assignment of cost center costs into a structure of program costs. This process will rely heavily on the parameters that control how faculty resources are drawn on by type of activity.

STAFF INPUTS: The STAFF and XSTAFF inputs are almost the same for 01, 02 and 03. STAFF is used to input characteristics common to all cost centers and XSTAFF is used to modify the characteristics for specific cost centers. The characteristics are rank, rank name, average salary, weekly staffing units, office space per staff at each rank, and number of staffing units credit (i.e., hours or half hours depending on the value of a unit) that are given for each contact hour of a specific type of activity. There can be five types of activities such as lecture, laboratory

and independent study for which different values per contact hour are given.

Five different kinds of non-teaching duties can be modeled. Non-teaching duties such as administration, research, student service, and professional development can be specified by rank and based on a table of values that are driven by the model. The table is referred to as the NBASIS table. It holds values that are derived in the model as each cost center is processed [Figure 2.6 lists the variables carried in this table]. Consequently, advising time of faculty could be a function of the number of students affiliated with that cost center.

STAFF 04 inputs the academic support staff common to all cost centers. The data includes the name of the staff, the average salary per period, office space required per individual and the number of contact hours of availability per week. At the present time the STAFF 04 input is not very useful because one cannot tie non-academic staff with the activities.

STAFF 05 provides data on non-academic staff by cost center. Non-academic staff can include graders, secretaries and student help. The input specifies type of non-academic staff, average period salary, office space and regression parameters to drive the number of non-academic staff. Again, regression coefficients can be used in conjunction with the values that are stored as each cost center is processed. Consequently, non-academic staff may depend on the academic staff at a

FIGURE 2.6

NBASIS TABLE

FUNCTIONAL BASIS FOR THE CALCULATION OF
INDIRECT RESOURCES AT A COST CENTER

Code Number	Description
1.	Absolute - value 1.0
2.	Affiliated students
3.	Affiliated enrollees
4.	Enrollee load
5.	Aggregate affiliated students
6.	Aggregate affiliated enrollees
7.	Aggregate enrollee load
8.	Number of academic staff
9.	Number of academic support staff
10.	Number of non-academic staff
11.	Total staff at the cost center
12.	Aggregate number of academic staff
13.	Aggregate number of academic support staff
14.	Aggregate number of non-academic staff
15.	Aggregate total staff
16.	Number of affiliated programs
17.	Aggregate number of affiliated programs
18.	Classroom space
19.	Laboratory space
20.	Total space
21.	Aggregate classroom space
22.	Aggregate laboratory space
23.	Aggregate total space
24.	Operating costs
25.	Aggregate operating costs
26.	Number of directly affiliated cost centers
27.	Absolute - Value 0.1
28.	Absolute - Value 0.01
29.	Absolute - Value 10.0
30.	Absolute - Value 100.0
31.	Absolute - Value 1000.0
32.	Total academic staff salaries
33.	Total academic support staff salaries
34.	Total non-academic staff salaries
35.	Total full time academic staff hired
36.	Total staff salaries
37.	Aggregate academic staff salaries
38.	Aggregate academic support staff salaries
39.	Aggregate non-academic staff salaries
40.	Aggregate total salaries
41.	
42.	Affiliated students in 100's
43.	Affiliated enrollees in 100's
44.	Enrollee load in 100's
45.	Aggregate affiliated students in 100's
46.	Aggregate affiliated enrollees in 100's
47.	Aggregate enrollee load in 100's
48.	Number of stations in a room
49.	Number of square feet in a room

cost center or it may depend on the number of enrollees at a cost center.

XSTAFF 04 The initial inventory, the transition percentages, (how many stay in the same rank and how many are promoted) the hiring code (can this rank be hired), maximum and minimums that can be hired, and the distribution of faculty among ranks are all specified on the XSTAFF 04 input. All inputs are by rank and cost center.

XSTAFF 05 is used to supply policy parameters regarding optimization and staff updating frequency. The following options are available.

1. Minimize the number of staff, or minimize the total staff salaries.
2. Staff up to non-teaching duties, or allocate only the excess staffing units to non-teaching duties, or ignore non-teaching duties.
3. Do normal staff transitions, or zero out previous inventory before each simulation period.

Staff update frequency is controlled by specifying the periods (Fall, Winter, Spring) to update staff.

STAFFING PROCESS: To gain a better perspective of the operation of the staffing modules in CAMPUS and the need for data to drive these modules, this part of the model will be explained in more detail.

Initial inventory that comes in on XSTAFF 04 by rank is used to

set up the inventory of staffing units in a cost center. Transitions (staff promotions and staff that leave) do not occur in the first simulation period. Otherwise transitions occur for every period an update of staff is required. When transitions occur, the percentage put in SAME (percentage that will stay in the same rank) on XSTAFF 04 is multiplied by the previous Inventory to obtain the number of staff that stay in that same rank. This number is multiplied by the promotion percentage to obtain the number of people in that rank that go to the next higher rank. Finally the minimum hire parameter is added to the staff at that rank to obtain the total staff by rank after transitions. In summary:

TLRKSF(K) = (SFPVIV(I) * SAME(I)) + (SFPVIV(I + 1) * PROMOTE (I + 1)) + MINHIR(I)

where

TLRKSF = Total Staff

SFPVIV = Previous Inventory

SAME = Percentage staying the same

PROMOTE = Percentage promoted

MINHIR = Minimum to hire

I = Rank

When no transitions take place, TLRKSF(I) = SFPVIV(I). In the first simulation period TLRKSF(I) is set equal to the initial inventory that came in on the XSTAFF 04 input.

The total staff by rank (TLRKSF(I)) is multiplied by the number of staffing units each staff member is available per week in that

cost center to derive total staffing units by rank. The number of staffing units of availability can vary by rank. The total staffing units are summed over ranks 1 and 2 and put into a part time supply (PARSUP). Ranks 1 and 2 are assumed by the model to be part time. Total staffing units summed over ranks 3-8 are put into full time supply (FULSUP). A summary of the results of this entire process is shown in Figure 2.7. Now that the supply of staffing units has been developed the model begins to assess demand. The first demand the model considers is non-teaching duties. If switch four (XSTAFF 05) has been set to "one" (staff up to non-teaching duties) then the model processes the STAFF and XSTAFF 03 input (non-teaching duties). Five different non-teaching duties can be specified. The non-teaching duties that were set up in experimenting with the model are compatible with the structure of categories used in the experiment done in this study [Chapter 3]. They are (1) Research and Scholarly Activity, (2) Public Service, (3) Student Support, (4) Department and Institutional Support and (5) Professional Development.

The model sums up the staffing units by type of non-teaching duty and by rank, using the regression parameters and the values in the NBASIS table. As an example, department and institutional services may be seventeen staffing units (half hour units) plus sixteen staffing units per staff member in the department. If the department had nine staff, the model would come up with a demand of 97 staffing units (46.5 hours) per week for administrative

FIGURE 2.7

ACADEMIC STAFF INVENTORY

BLOCK TIME RUN OF JAN 20 1971 6 COST CTR MODEL

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.2
SESSION 1969/70
SIMULATION PERIOD 3

COST CENTER LEVEL	NODE
1 DEPARTMENT	5 ACCOUNTING
AFFILIATED WITH	3 INSTRUCTION

ACADEMIC STAFF INVENTORY BY RANK

RANK	PREVIOUS INVENTORY	INVENTORY AFTER TRANSITION	NEW STAFF	TOTAL STAFF	AVERAGE SALARY ($)	TOTAL SALARY ($)	STAFFING UNITS PER RANK	TOTAL UNITS ACCUMULATED	COST PER STAFFING UNIT ($)
TEACHING ASSOC 1	2	0	2	2	1200	2,000	36	72	27
TEACH ASSOC 11	3	0	3	3	1200	4,000	36	108	37
PROFESSOR	2	2	0	2	7000	14,000	99	198	70
ASSOC PROFESSOR	5	5	0	5	5500	28,000	99	495	56
ASST PROFESSOR	3	3	0	3	4500	14,000	99	297	47
TOTAL	15	10	5	15	4200	62,000	78	1170	53

functions. The seventeen units allow for a department head who is quarter time, and an assumption is made that all staff are available 99 staffing units per week. See Figure 2.8 for an example of a cost center report showing the non-teaching duty demand. The other options for non-teaching duties are to (1) ignore non-teaching duties altogether (Switch 4 = 3, XSTAFF 05), or distribute only the excess staffing units to non-teaching duties after the allocation of staffing units to direct teaching activities (Switch 4 equals 2 on XSTAFF 05).

The second demand consideration, depending on the policy chosen in handling non-teaching duties, is the direct teaching duties. Contact hours are passed to the staff module from the activity build module. These contact hours are by type of activity (lecture, laboratory, independent study) and by type of staff requested such as full time, part time or general where general means either full time or part time. The staff module sums up the staffing units required for direct teaching duties by multiplying staffing units credit [by type of activity per contact hour (STAFF and XSTAFF 02)] by the number of contact hours in that type of activity.

Example:

Cost center "accounting" has a demand on activities that require

(a) 60 contact half hours of lecture 1 type activities for part time staff (instructors or Grad assistants)

(b) 75 contact half hours of lecture 1 type activities for

FIGURE 2.8

BREAKDOWN OF DIRECT ACTIVITY AND NON-ACTIVITY LOAD

COST CENTER

LEVEL	NODE
1 DEPARTMENT	5 ACCOUNTING
AFFILIATED WITH	3 INSTRUCTION

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 3

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	180	33	6,000	60	99
LECTURE1	FULL-TIME	225	56	13,000	75	168
LECTURE3	FULL-TIME	45	56	3,000	45	56
TOTAL DIRECT ACTIVITY LOAD		450	49	22,000	180	123
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	230	56	13,000		
RESEARCH	GENERAL	240	56	13,000		
PUBLIC SERVICE	GENERAL	60	56	3,000		
PROF DEVELOP	GENERAL	60	56	3,000		
STUDENT SUPPORT	GENERAL	90	56	5,000		
TOTAL NON-ACTIVITY LOAD		680		37,000		
EXCESS STAFFING UNITS		40		2,000		
TOTAL FOR ALL STAFF LOADS		1170		62,000		

full time staff (assistant professors, associate professors and full professors)

(c) 45 contact half hours of lecture 3 type activities for full time staff.

If lecture 1 type activities are given 3 hours of credit to staff each contact hour and lecture 3 type activities are given 1 hour of credit for staffing each contact hour, then the total direct activity load generated in accounting would be:

(a) 60 * 3 = 180 part time half hours

(b) 75 * 3 = 225 full time half hours

(c) 45 * 1 = 45 full time half hours

Total part time	180 half hours
Total full time	270 half hours
Total	450 half hours

See Figure 2.8 for an example of a cost center report showing this output.

At this point in the processing the staff module has accumulated both the supply and the demand of staffing units at a cost center If demand is greater than supply, a hiring situation is assessed.

Hiring is controlled by a number of parameters. Hiring will not take place if the hiring code is off (XSTAFF 04). Hiring at a specific rank will not take place if the maximum number that can be hired in a rank is reached for that rank. Hiring is also controlled by the minimum and maximum percentages desired in a rank. The rank with the greatest gap (Minimum percent minus Actual percent) is hired. Otherwise a check is made to see

whether one desires to minimize number of staff or minimize total staff salaries (XSTAFF 05, Switch 3). If it is desired to minimize total staff, the rank with the highest staffing units available per week that has room (i.e., actual percent distribution is below maximum percent specified) will be hired. If all ranks have the same availability of staffing units specified per staff, then the lowest rank is hired. If all ranks are equal or over the maximum percent, the rank with the smallest percent over the maximum is selected for hiring.

If it is desired to minimize total staff salaries then the rank hired is the one with the lowest cost per staffing unit where the actual percent distribution in ranks is less than the maximum specified.

Restraints on hiring force the model into considering other alternatives. If the model cannot hire full time (ranks 3-8), it will try to hire part time (ranks 1-2). If the model is restrained so that it cannot meet demand at all, then the excess demand is distributed to the supply rank by rank, weighted by the available staffing units per staff in each rank as a percentage of the minimum available staff units across all ranks.

After all demand is assessed, the staffing module goes on to calculate total salaries by rank, costs per staffing unit by rank, cost of non-teaching duties, cost of excess staffing units, cost of teaching duties by type of activity and total cost of teaching and non-teaching duties.

PLANNING MODELS SUMMARY

Both the CAMPUS and RRPM models are in the embryonic stages of development. More research and work must be done to upgrade these models for widespread use, especially in larger institutions. Both CAMPUS and RRPM have potential of becoming good models. It appears that as both of them progress, they will grow into one flexible model to be used at any level of aggregation desired on the part of the user. One element common to all models in higher education is that they depend heavily on reliable parameters to define the relationship between variables.

SUMMARY

This chapter has summarized extensively the state of the art regarding faculty activity analysis. There have been a number of studies attempting to measure faculty activities and/or faculty load in some form. Many of the studies in the past have measured load only in terms of credit hours or contact hours. Recently more and more studies are recognizing the need to measure the non-teaching activities of faculty. This is being done by estimating the percent of total time that is allocated to specific activities or by estimating hours.

The demand for such data is increasing as analysts, planners and administrators struggle to meet the resource allocation problems in higher education. The data is needed for simulation models, program costing and cost/benefit analysis.

This situation emphasizes the need to do more research on how to collect faculty activity data.

> The validity and relevance of various methodologies used to answer analytical questions relating to use of faculty have received far less attention than questions concerning whether or not faculty activity surveys should be conducted at all. However, questions relating to faculty time studies no longer need be concerned with "if" but rather must pertain to "how". The critical issue concerns the quality of the methods used to collect and analyze the data [Romney, 1971].

CHAPTER III

AN EXPERIMENT USING ACTIVITY SELF SAMPLING

STUDY DESCRIPTION

BACKGROUND

The impetus for this study came from a number of sources. (1) There has been a general feeling around University circles that the questionnaire approach for measuring the activity of faculty is highly inaccurate because it relies so heavily on recall over a long period of time. (2) The CAMPUS model requires a number of parameters regarding faculty activities; and (3) Very little work has been done using sampling approaches to gather data on faculty. The initial ideas for the study came from the research done by Ritchey [Chapter II] and from Professor Gary Andrew at the University of Minnesota who had done some thinking on the subject as a result of the Ritchey study. Further imeptus for the study came from WICHE's interests in doing further research on the faculty activities area. Their research has concentrated on defining faculty activities such that standards can be developed for institutional comparisons.

SAMPLING TECHNIQUES

HISTORY: Self-sampling methods operate under the same concepts as work sampling methods used in industrial engineering. Work sampling has been used as a work measurement technique since 1935. L. H. C. Tippett, a British statistician, used statistical sampling in studying the patterns of loom breakdown in a textile mill in England [Tippett, 1935: 51].

Later, in 1940, Morrow discussed the same concepts that Tippett had used in studying delay allowances. He called this type of study "ratio delay study" [Morrow, 1940]. The term "work sampling" was introduced in an article in Factory Management and Maintenance in July 1952 by C. L. Brisley who at that time was working with the Wolverine Tube Division of Calumet and Hecla Consolidated Copper Co. Since the early 1950's, work sampling has been applied in many situations. The activity of workers has been studied in connection with chemical-plant operation, industrial construction, railroad-yard switch-engine activity, office activities, machine utilization, service station layout designs, and the utilization of engineers [Heiland and Richardson, 1957: 10]. Fur further reference on work sampling studies see the bibliographies in Heiland and Richardson and in Hanson. Heiland and Richardson describe the process of work sampling as follows:

> Work Sampling is a measurement technique for the quantitative analysis, in terms of time, of the activity, of men, machines, or of any observable state or condition of operation. Work Sampling is particularly useful in the analysis of non-repetitive or irregularly occurring activity, where no complete methods and frequency description is available. It is also an extremely useful device with which to make an inexpensive over-all survey of office, shop, or service activity. Such a preliminary study can help evaluate the need for further study, and it may serve to establish a "bench mark" for managerial purposes. Because it is extremely convenient, possesses known reliability, and because it operates without recourse to the stop watch or to subjective judgments of "effort" or "performance," Work Sampling seems to be assured of wide adoption in the future [Heiland and Richardson, 1957: 1].

THE PROCESS OF WORK SAMPLING: Work sampling is a process of sampling activity at random points in time. What is recorded at the observation point depends upon the objectives of the study. The study may be interested in the type of activities being performed, or it may be interested where the activity is being performed. Either one or both may be recorded at the observation point. The number of observations required to make inferences regarding the entire population of activity depends on the reliability required. The higher reliability desired, the more observations that are required. If one desires to set up a 95 percent confidence limit for an activity category where 10 percent of the observations are expected, then the number of observations (N) required for the surveys can be determined by the formula

$$\sigma_p = \sqrt{\frac{P(1-P)}{N}} \qquad \text{or} \qquad N = \frac{P(1-P)}{\sigma_p^2}$$

Since $2(\sigma_p)$ = 47.72 percent of the area under the normal curve, $P \pm 2(\sigma_p)$ will equal 95.44 percent or approximately 95 percent of the area. To obtain this level of confidence the formula can be re-written and solved for the number of observations needed. If we wish to evalute "p" so that the sampling error is reduced to the point where one can say the chances are 95 out of 100 that "p" is correct to within ±1 percent, then

$$2\sigma p = 2\sqrt{\frac{P(1-P)}{N}} = .01$$

Solving this for N,

$$N = 40{,}000\ P(1-P).$$

Consequently, if P is expected to be five percent for a category, then N must be 1900 (i.e., 40,000(.05)(.95)) to obtain a 95 percent confidence interval.

The process of performing work sampling involves the following steps.

1. Classifying into categories the activity to be studied.
2. Designing the necessary forms.
3. Developing properly randomized times of observation.
4. Observing activity and recording data [Heiland and Richardson, 1957: 50].

Setting up the categories is perhaps one of the most difficult tasks. Categories must be set up so that they meet the objectives of the study. All activity must be covered in the study, consequently each observation has to fit in some category. It is difficult to predict ahead of time all of the specific types of activity that will occur. Consequently, judgments have to be made during the study to classify activities that were not previously specifically defined. The design of the study should define general classes of activities into categories so that there are guidelines to classify specific activities during the study. There is no fixed optimum number of categories. However, limiting the number of categories has the following advantages [Heiland and Richardson, 1957: 52].

1. The study is easier to take.
2. Reliability will improve for each of the categories,

> since there will be a greater number of observations per category [Heiland and Richardson, 1957: 52].

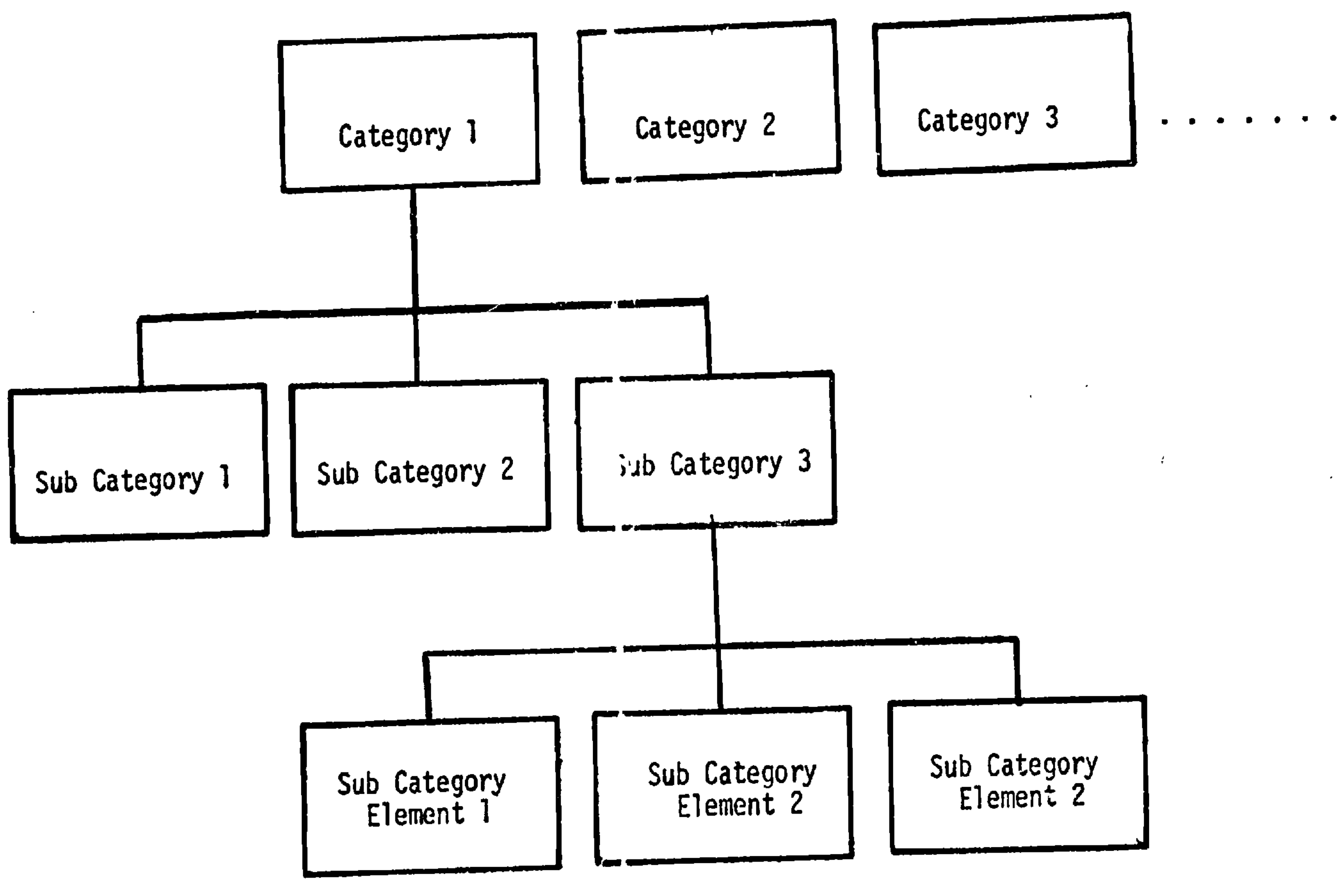
Categories can be structured in a hierarchical setting so that observations can be divided into smaller sets of categories. Figure 3.1 shows an example of this approach.

As activities are observed, they are classified into the sub-category elements. The data can be analyzed at this level to obtain percentages of time by element, or the data can be aggregated up to the sub-category level and analyzed at this level. This cuts down the number of categories in total, and hence increases the reliability by category.

SELF SAMPLING VERSUS WORK SAMPLING: The process of self sampling is the same as work sampling except that the one being observed is also the observer. The individual observer observes his own activity. This has advantages and disadvantages. The main disadvantage is that the observer may not be objective in classifying his activity. He can easily record what he was doing into an activity that would make him look better. Also, there is less consistency in the interpretation of categories since there are many more observers. In the traditional work sampling approach, the number of observers can be one or more depending upon the size of the sample being observed. In self sampling there is one observer for every individual being observed. It is possible to have the same situation in work sampling; however, it is not usually the case.

FIGURE 3.1

HIERARCHICAL STRUCTURE OF CATEGORIES



A disadvantage of the traditional work sampling approach is the effect of the observer on the one being observed. The one being observed may change his behavior during the study. He may also get annoyed with having someone following him around. If the observer doesn't follow him around, then there are problems of finding him at the point that the observation is to be made. This requires the one being observed to recall his activity at the point the sample was to be taken, which may be up to a day later.

The main advantage of the self sampling approach is the ability for the individual to more accurately classify the activity he was engaged in. You will note that this was also considered a disadvantage. However, assuming that the individual is concerned about accurate measurements of his activity, he can be a better judge of the activity he was involved in than an independent observer. This is especially true when one is measuring activities that cannot easily be observed. Time studies on professional people where one is concerned with the allocation of time to different jobs for job reporting is impossible to do with an independent observer, unless the observer asks the one being observed.

John White, Staff Assistant at Westinghouse made the following comments when talking about traditional work sampling

> This technique, however, is not completely satisfactory in its traditional form for studying design and development engineering activities. Work sampling relies on the ability of an observer to identify and classify work elements of the observed. The creative elements of engineering work often involve intangible activity;

> the "Think" element is frequently predominant. Creative activity can nullify the traditional approach, since the observer often cannot identify this kind of activity.
>
> Other reasons for abandoning the traditional approach of work sampling are worth mentioning. Application of work measurement techniques to the activity of professional engineers might cause serious morale problems. Also, engineers often are very mobile. Their duties take them to a variety of locations within the plant-office complex. As a result, a work sampling analyst would have great difficulty in locating subject engineers at the arrival of random times. Difficulty of identifying creative activities, the possibility of morale problems, and the mobility of engineers all contributed to abandonment of normal work sampling methodology for analysis of engineering time utilization [White, 1968: xix].

SELF SAMPLING NOTIFICATION METHODS: A unique aspect of the self sampling method is the need for a method of telling the individual when to sample his activity. Under the traditional approach, times of the day are randomly selected ahead of time and the observer references this list in making the observation during the day. The one being observed is not involved with the time to be observed. Under self sampling some system has to be set up to notify the individual when to sample his activity and still maintain a random selection of times. There are a number of approaches to doing this.

a) Record on a card random points for each day for each individual to be sampled. The individual will recall at the end of each day what he was doing at the times indicated on the card.

b) Use the same method as above, except use a device to signal the point to the individual as he progresses through the day. There are various forms this process can take.

(1) The individual uses the alarm on his wrist watch and sets the time of the next alarm according to the times on his card. If wrist watches aren't available, an inexpensive memo timer can be used [See Appendix B].

(2) Preprogram the points on a device that will sound an alarm for each point that has been preprogrammed. (The author, along with Professor Gary Andrew, at the University of Minnesota, spent many hours coming up with a prototype device that could be programmed for up to two weeks of points. The device was never put into production since more work was needed to improve the design and to increase its reliability. There wasn't sufficient time to accomplish these tasks for this study.)

(3) Have some one signal the points via a communication system. This is very similar to the traditional approach of work sampling except the other person (observer) only performs the process of signalling the point and does not observe the activity. This can be done in the same way as work sampling where the observer goes to the individual sampling and notifies him that it is time to sample. Another process is to use the telephone. However, both of these methods are not very satisfactory if the individual being sampled has activities in multiple locations.

An approach to this problem, the problem of mobility, is to use a radio system. A short wave system was considered for this study, however, there are problems with it also. An operator is required continuously for making calls. Again, the points are randomly set up ahead of time and the individual is called as each point in time comes up. The system is somewhat expensive and a license is required [See Appendix B for details]. Other disadvantages of the short wave system are problems with distance, the bulkiness of the units and the cost. The units must be on all the time and they can be very disturbing when the individual is contacted.

Another radio method is the FM signaling system used by repair servicemen and doctors. The units sound a tone which signify to the individual that he is to call his office for a message. The unit can be used for sampling in the same manner except the individual would record what he was doing at the time of the tone rather than make a call to his office. This system solves a lot of the disadvantages of the preceding methods cited. The distance is from 3 - 10 miles, cutting down on this problem. The units have a tone that is not disturbing to people around. The one disadvantage is the cost of a base station and the time required to get a

license. However, the units can be used for many other things on campus when they are not being used for time studies. These systems can be purchased from various electronics manufacturers [See references in Appendix B].

c) The last type of device is a self contained device that will generate random alarms requiring no operator. The author was able to find only two such devices on the market in this country. A number of letters were also sent to various foreign countries in search of such a device. The first device that was tested was a random signal generator distributed by Meylans [See Appendix B]. It was a heavy device (10 oz.) to carry around and it had a high drain on batteries. It would use $3.00 worth of batteries per week. The units (at $235) were also very expensive. However, the unit was very reliable and well built. The adjustment of the mean interval between alarms was limited to 30 minutes at the longest interval. The author contacted the manufacturer and found that they could lengthen this time interval on a special order.

The last device that the author found was a smaller, and less expensive device built explicitly for work sampling studies. The device had been in production for only about two years. It sells for $60 per unit and the battery lasts for about 1.5 years. The device is set at

the factory for almost any time interval desired. It is small enough to be carried in a shirt pocket.

SELF SAMPLING STUDIES: Very little work has been done with self sampling, and hardly any work has been done in the academic environment. Appendix J summarizes all of the self sampling studies the author was able to locate. The one study that was done in an academic environment was with a librarian. Two self sampling studies have been done with engineers, one with doctors and one with a clerical pool. All of these studies used different signaling methods. The most recent study (doctors) used the same device used in this thesis.

THE RANDOM SAMPLER: The random sampling unit called the RAM (Random Alarm Mechanism) is built by Electronic Ideas Inc. in Wyncote, Pennsylvania. The unit is housed in a metal case 2 inches wide by 2 1/2 inches high and 3/4 inches deep. This is a little smaller than a cigarette package (See Figure 3.2). The unit weighs about 3 ounces and it has a small speaker attached to it that weighs about an ounce. The speaker is actually a small Japanese made crystal microphone with a jack that plugs into the unit. The author fastened the unit to a plastic checkbook case to make the unit more convenient to carry. The speaker was clipped to the case, and the case had a flap on one side to carry the data card. The entire unit could be closed like a checkbook and slipped into a shirt pocket. The unit's alarm was a high frequency tone that came from the speaker. The tone would last for 10 seconds and automatically shut off. A small wheel at

FIGURE 3.2

RAM-1 SAMPLING UNIT

the top of the unit was used to randomly set the arrival of the next alarm. The wheel had four tracks on it, one for each of four capacitors. The tracks had a pattern of off and on contacts. Consequently, when the wheel was turned, some combination of ca· :tance would be connected. Since there were four capacitors and each capacitor was either off or on, there were 2^4 or 16 combinations of time intervals. The interval between alarms would theoretically be the same if the wheel was not turned. However, the unit is sensitive to temperature and humidity changes, so this will also affect the length of the interval.

Operation of the unit is very simple. The battery is connected at the factory and there is no off and on switch. Consequently, the unit is running all the time. The speaker jack can be disengaged at night or when the unit is not being used so that the alarms cannot be heard. When the participant starts sampling he just plugs the speaker in and waits for an alarm (tone). For each alarm the individual records what he was doing at the time of the alarm on the data card, turns the wheel to randomly set the next interval, and proceeds with his regular duties.

CATEGORY DEFINITIONS

The development of definitions for use in this study went through various phases. Definitions were initially developed on the basis of past surveys. These definitions went through a series of modifications reflecting influences of Henle's structure [Henle], working drafts by the WICHE ad hoc design group, the WICHE program classification structure and the needs of the CAMPUS

model. The WICHE program classification structure [Gulko, 1970] and the needs of the CAMPUS model ended up as being the most significant influences in the structure of the definitions used in this study. Figure 3.3 shows a set of relationships that could be set up between the WICHE structure and the category structure used in this study. The relationships are not fixed. They can be altered depending on the desires of the decisions made and the flexibility of the system. The relationships shown do not necessarily coincide with WICHE's intent. WICHE's structure assumes that there are formal programs established under research, public service, academic support, student services and institutional support.

Although WICHE documentation is not specific, it appears that it was not their intent to include faculty time for student support or academic support in these programs, unless the faculty member has a specific assignment for a specific portion of time. Consequently, faculty time spent advising a student would be a part of the direct costs of teaching the courses he is assigned to, and would not be a part of the student support program.

As was shown in Chapter 2, the CAMPUS simulation model requires various parameters on teaching duties. The present form of the model requires the amount of time one gives for each contact hour of class time by type of course and by cost center (department). It also requires the amount of time for what the model classifies as non-teaching duties by type of duty, by rank and by cost center. Consequently, non-teaching duties have been

FIGURE 3.3

Relationship of Faculty Activity Analysis Category Structures to WICHE Program Classification Structures

WICHE Program Classification Structure		Faculty Activity Analysis Category Structure
I. WICHE Primary Program	I-A	1.1 Instruction - Course Related
A. Instruction	I-A	1.2 Instruction - Student Related Research and Other Instruction
B. Organized Research		2.0 Research and Scholarly Activity
C. Public Service	I-B	2.1 Sponsored
	I-B or II-A	2.2 Department
II. WICHE Support Programs	I-C	3.0 Public Relations and Service
A. Academic Support	II-A	4.0 Departmental Services
B. Student Support	II-B	5.0 Student Support Services
C. Institutional Support	II-C	6.0 Institutional Services
D. Independent Operations	II-A	7.0 Professional Development

set up in the model to reflect the categories of (1) Research and Scholarly Activity, (2) Public Relations and Service, (3) Departmental and Institutional Services, (4) Student Support and (5) Professional Development. The definitions and examples used in this study to classify specific activities into the categories are listed in Figure 3.4.

POPULATION

The population used in this study was the Business School faculty at the University of Minnesota. A meeting was held with the executive committee of the School in October of 1970. This committee consists of the dean, assistant dean, and the six department chairman. The objectives of Project PRIME [See Appendix A] were reviewed at this meeting. The faculty activity analysis segment of the project was also reviewed. It was suggested in this meeting that a meeting of the entire faculty be called to review the project. Some thought was given to selecting a group of faculty to participate in the study on the basis of a random draw. However, a lot of cooperation would be required to complete the study, and it was therefore decided to select the study group out of a population that would like to participate in the study. A questionnaire was given to the entire full time faculty [Appendix C-1]. The plan was to select ten to fifteen faculty to sample over the quarter (Twelve full weeks). It was suggested in the executive committee meeting that more faculty be included and that each faculty sample for a shorter period of time. It was decided to ask each of the faculty in the questionnaire how long

FIGURE 3.4

FACULTY ACTIVITY DATA CARD CATEGORY DEFINITIONS

1.1 INSTRUCTION – COURSE RELATED

Classroom Contact· All time spent in the classroom during scheduled hours. Additional regularly scheduled labs, help sessions, etc. are to be included.

Evaluation· Time spent on the course in grading papers, exams, and determining grades. In general it is all evaluation work that is variable with the number of students.

Other Contact· Contact time spent with students related to the course outside of scheduled class or lab times. (Student program advising and other non-instruction related activities should be recorded in "Student Support Services", section 6.0)

Preparation· All time spent in preparing course materials, lectures, readings, tests, etc. In general this covers all activities related to the course outside the classroom that are nonvariable with the number of students. This also includes preparation for courses to be taught in future quarters, as well as minor curriculum development. It also includes all other miscellaneous activity pertaining to the course that can't be classified in the above categories.

1.2 INSTRUCTION – STUDENT RELATED RESEARCH AND OTHER INSTRUCTION

This category includes all time spent on dissertation and thesis activity, Plan A and Plan B papers, and Ph. D. and Masters exams. It also includes all other consulting with students on subject matters other than consulting related to a course presently being taught by you. (3-XXX equals Undergrad level students, 5-XXX equals Masters level students, 8-XXX equals Ph.D. level students.)

2.0 RESEARCH AND SCHOLARLY ACTIVITY

This category includes all research, creative and scholarly activity done primarily with no students. Included are writing (published or unpublished), research projects (proposal work, research work, results dissemination), and works of art. Separate University funded and departmental activity (DEPARTMENT) from externally funded projects (SPONSORED). All activity in this category not specifically funded is to be classified as department research. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

3.0 PUBLIC RELATIONS AND SERVICE

This category includes all activities related to consulting, speaking engagements, recruiting students, and offices in professional organizations. Do not include civic, private and church organizations unless you are specifically representing the college or university. Put paid and unpaid consulting on separate lines. Unpaid includes consulting done for a nominal fee. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

4.0 DEPARTMENTAL SERVICES

This category includes all administrative duties related to departmental services. Included are department meetings, department committee assignments, major curriculum development, recruiting faculty, and all correspondence, reading, phone conversations, and clerical work regarding departmental activities.

5.0 STUDENT SUPPORT SERVICES

This category includes all services related to advising student programs and activities, directing student performances, and all other services for the student such as letters of recommendation, etc. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

6.0 INSTITUTIONAL SERVICES

This category includes all services provided for administrative activities beyond the department level. Included are committee work, meetings, and all correspondence, reading, phone conversations, and clerical work related to School of Business Administration or University activities.

7.0 PROFESSIONAL DEVELOPMENT

This category includes all activities related to professional reading (nonspecificto a present course), seminars, workshops, conferences, conventions (Offices held are classified under Public Service), taking courses, and attending faculty discussions and seminars. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

8.0 PERSONAL TIME (WORK)

This includes time that should be charged to the other categories proportional to the amount of time spent in those activities. This would include all personal activity intermixed with regular faculty activities. Normally it's an interruption of short duration (1/2 hour or less) such as a personal phone call, personal break (coffee, etc.), or other activity that can't be assigned to any one specific activity.

9.0 PERSONAL TIME (OTHER)

This refers to all personal time while not at work. Normally, time spent with the family, personal errands, and all other activities non-related to the activities above will be a part of this activity.

they would be willing to sample. Four choices were given: (1) Twelve weeks; (2) Six weeks; (3) Three weeks; (4) Zero weeks. The results of this questionnaire were:

Twelve weeks	10
Six weeks	8
Three weeks	16
Zero weeks	13

On the basis of this response it was decided to run eighteen units per week according to the design as shown in Figure 3.5.

It should be noted that this procedure did not control the composition of the groups. Consequently, there can be differences between the 12 week, 6 week and 3 week groups due to differences in the make-up of each group.

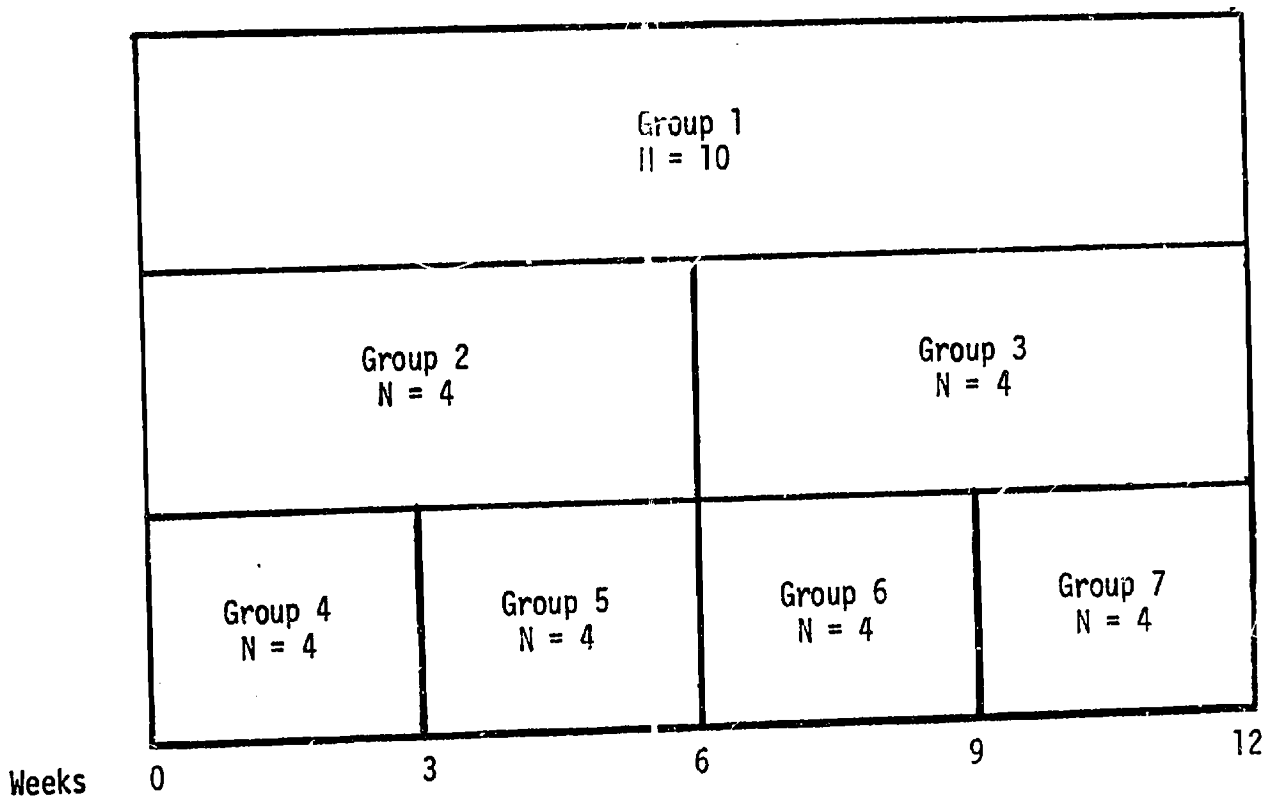
The following tabulation of administration and rank exemplifies just two of the many factors that can contribute to differences in the groups.

	Admin	Full Prof	Assoc Prof	Asst Prof	Total
12 Week	4	4	6	0	10
6 Week	0	0	2	6	8
3 Week	3	5	6	5	16

A lot of emphasis was placed on insuring the faculty (both in meetings and on the questionnaire) that the data would be maintained in strict confidence. All data was collected via an assigned number. The cross reference of number to name was available only to the author and a data clerk.

FIGURE 3.5

Distribution of Groups Over 12 Week Quarter



N = 18 each week

DATA COLLECTION

Data was collected during Winter quarter, January 4, 1971 through March 28, 1971. A number of meetings were held in small groups and with individual faculty members during December 1970 to go over the instructions for using the random sampling device, the data collection procedures, and the category definitions. A form was handed out at these meetings to obtain estimates of what the faculty thought they would spend in each of the categories during the quarter. The form used for this procedure was in the same format as the one shown in Appendix C. There were two reasons for the pre estimate: (1) It required the faculty member to think about the definitions and his expected activity for the quarter and how it would fit the categories. (2) It was used to determine how closely the faculty could predict the amount of time they thought they would spend on different activities.

Some sampling units were distributed during December to pilot test the use of the units and the data recording procedures. All participating faculty had a chance to experiment with the units two to three days before they started sampling.

The study was set up to cover all faculty activity 24 hours per day seven day a week. In order to give the faculty member flexibility in covering all his activity, the data collection was set up so that he had two options. He could sample any segment of the day that he desired, or he could log any segment of the day. The flexibility was given for the following reasons: (a) There would be situations where it would not be convenient

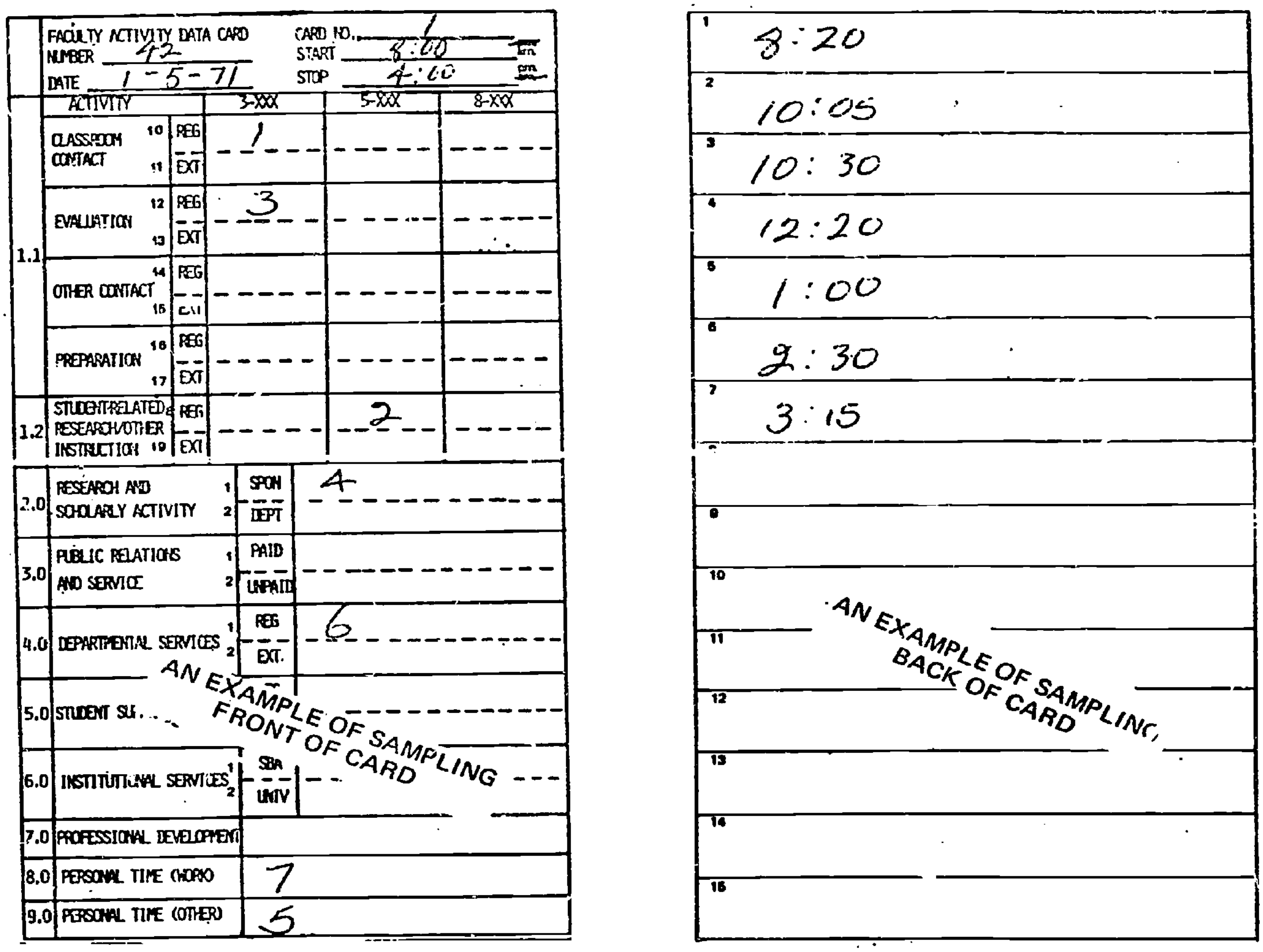
to sample (i.e., trips, meetings outside the university, etc.). b) Devices may be forgotten or may fail, and some means was necessary to pick up this time interval. (c) There would be blocks of time where only one activity occurred that would be more convenient to log than sample.

Consequently, data was recorded in two ways. During a sampling segment the faculty member recorded the time of the alarm on the back of the card in a box [See Figure 3.6]. Then he took that box number and placed it on the front of the card in the activity category corresponding to what he was engaged in at the time of the alarm. The top of the card was filled in with the number of the individual sampling, the date of the sample and the start and stop times encompassing the sample points on the card.

Logging time involved filling out another card. Only the front of the card was used. Hours and minutes spent on a particular activity were recorded directly into the proper box on the front of the card. The times recorded in the body of the card would correspond to the time interval shown by the start and stop times on the top of the card. Weekend activity could be logged on one card if desired. It was not necessary to record start and stop times on the weekend. Start and stop times for logged activity were not necessary during the week either, if the hours were recorded correctly. However, it was desired to have this information for control, and for purposes of looking at activity stratified by time of day. An example of a logged segment is shown in Figure 3.7. An example of the instruction booklet

FIGURE 3.6

A SAMPLE SEGMENT ON A DATA CARD



FACULTY ACTIVITY DATA CARD
NUMBER 42
DATE 1-5-71
CARD NO. 1
START 8:00 a.m.
STOP 4:00 p.m.

	ACTIVITY			3-XXX	5-XXX	8-XXX
1.1	CLASSROOM CONTACT	10	REG	1		
		11	EXT			
	EVALUATION	12	REG	3		
		13	EXT			
	OTHER CONTACT	14	REG			
		15	EXT			
	PREPARATION	16	REG			
		17	EXT			
1.2	STUDENT-RELATED RESEARCH/OTHER INSTRUCTION	18	REG		2	
		19	EXT			

2.0	RESEARCH AND SCHOLARLY ACTIVITY	1	SPON	4
		2	DEPT	
3.0	PUBLIC RELATIONS AND SERVICE	1	PAID	
		2	UNPAID	
4.0	DEPARTMENTAL SERVICES	1	REG	6
		2	EXT.	
5.0	STUDENT SE...			
6.0	INSTITUTIONAL SERVICES	1	SBA	
		2	UNIV	
7.0	PROFESSIONAL DEVELOPMENT			
8.0	PERSONAL TIME (WORK)			7
9.0	PERSONAL TIME (OTHER)			5

AN EXAMPLE OF SAMPLING FRONT OF CARD

1	8:20
2	10:05
3	10:30
4	12:20
5	1:00
6	2:30
7	3:15
8	
9	
10	
11	
12	
13	
14	
15	

AN EXAMPLE OF SAMPLING BACK OF CARD

FIGURE 3.7

A LOGGED SEGMENT ON A DATA CARD

FACULTY ACTIVITY DATA CARD
NUMBER 42
DATE

CARD NO. 2
START 5:00 PM
STOP 10:30 PM

	ACTIVITY			3-XXX	5-XXX	8-XXX
1.1	CLASSROOM CONTACT	10	REG			
		11	EXT			
	EVALUATION	12	REG			
		13	EXT			
	OTHER CONTACT	14	REG			
		15	CA			
	PREPARATION	16	REG			
		17	EXT			
1.2	STUDENT-RELATED RESEARCH/OTHER INSTRUCTION	18	REG			
		19	EXT			
2.0	RESEARCH AND SCHOLARLY ACTIVITY	1	SPON			
		2	DEPT			
3.0	PUBLIC ... AND SERVICE					
4.0	DEPARTMENTAL SERVICES	1	REG			
		2	EXT			
5.0	STUDENT SUPPORT SERVICES	1	REG			
		2	EXT			
6.0	INSTITUTIONAL SERVICES	1	SBA			
		2	UNIV			
7.0	PROFESSIONAL DEVELOPMENT			2:30		
8.0	PERSONAL TIME (WORK)					
9.0	PERSONAL TIME (OTHER)					

AN EXAMPLE OF LOGGING HOURS ON THE SAME DAY

each participant had is shown in Appendix C.

Data was turned in at the end of each week. A tally was kept on the cards turned in so that if cards were missing for a participant, he could be contacted and reminded. The cards were checked for completeness and missing data. In some cases the logged data came in on pieces of paper which had to be transferred to the regular data cards. After the initial editing, the cards were sent directly to keypunching where they were keypunched and verified. The front of the sample card was punched on a card called a "one" card (1 in Column 80). The back of the sample card was punched on another card called a "two" card (2 in column 80). Both cards had the same control information in columns1-19. See Appendix E for the card layout. The logged card was punched into a "five" card (5 in column 80). The punched cards were then sorted by participant number and date and run through a computer program to do further editing. This program performed the following tasks:

1. Merged the "one" and "two" cards into one record for processing.
2. Converted all times into military time in hundreds of hours, i.e., 5:30 p.m. equals 17.50.
3. Calculated the interval between start and stop times for any interval up to 24 hours starting at any time during the day.
4. Check to make sure that all times indicated on the back of the sample card were descending and within the range of the interval specified by the start and stop times.

5. Check to make sure that the category numbers keypunched were proper numbers.
6. Check to see that the number of points on the front of the sample card corresponded with the number of times on the back of the card.
7. Allocated the time on sample cards across the categories.
8. Added up the hours sampled, logged, and in total by category for each individual. It also summarized these hours by category, by individual within week or by week within individual.
9. Percentages and averages were calculated by category for each individual and in total.
10. The number of points sampled was added up and divided into the number of hours sampled to obtain the average interval by individual and in total.
11. Card counts were made by type of card.

A sample of the report is shown in Figure 3.8. There was an average of about 10 errors per week that were found by the edit program. The output from the edit program was checked manually 100% against the original data cards to make sure all the hours per day were picked up correctly. A sample of 3 cards per individual per week was selected to audit the accuracy of the distributions. An average of .5 errors per week were found in this audit. A flow chart of the entire input system for the data is shown in Figure 3.9.

Each group was asked at the end of their sample period to again

estimate the amount of time they spent in each category. At the end of the quarter a questionnaire was sent out to all faculty as well as teaching assistants to obtain an estimate of time spent for the quarter by category [See Appendix C]. In addition, the faculty in the study during the quarter were asked to fill out a survey regarding their opinions on the study that was conducted [See Appendix C].

PROJECT PRIME

FACULTY ACTIVITY ANALYSIS 1-4 TO 1-10

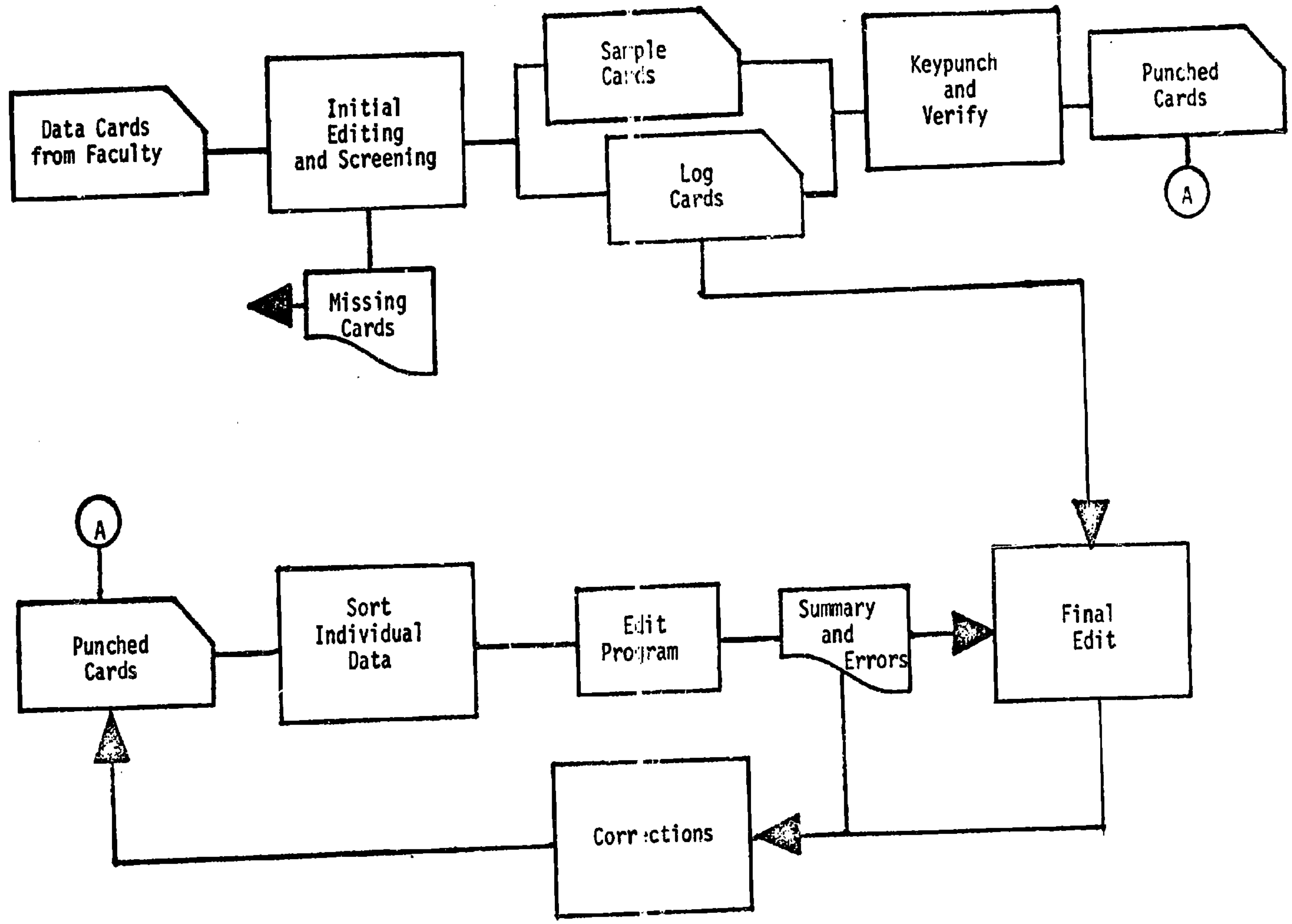
NO.	DATE	START	STOP	HOURS L/S	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	PER-W	PER-O
7	104	6.00A	18.00P	12.00 S	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	104	22.00P	3.00A	5.00 L	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	105	9.00A	18.00P	9.00 S	3.00	0.00	0.00	3.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	106	8.75A	16.00P	7.25 S	0.00	0.00	0.00	0.00	0.00	4.83	0.00	0.00	0.00	0.00	0.00	0.00	2.42
7	106	12.00	12.00	2.00 L	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	106	12.00	12.00	4.00 L	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	108	9.00A	18.00P	9.00 S	0.00	0.00	0.00	0.00	0.00	1.29	0.00	0.00	0.00	5.14	1.29	1.29	0.00
7	108	9.00A	17.25P	8.25 S	1.65	0.00	0.00	0.00	0.00	6.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	108	9.00A	18.00P	9.00 S	0.00	0.00	0.00	0.00	0.00	1.29	0.00	0.00	0.00	5.14	1.29	1.29	0.00
7	108	12.00	12.00	3.00 L	0.00	0.00	0.00	0.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	110	12.00	12.00	2.00 L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
7	109	12.00	12.00	2.00 L	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	PERIOD TOTAL SAMPLE			54.50 S	4.65	0.00	0.00	3.00	0.00	29.00	0.00	0.00	0.00	10.29	2.57	2.57	2.42
	PERIOD TOTAL LOGGED			18.00 L	0.00	0.00	0.00	4.00	2.00	10.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
	PERIOD TOTAL HOURS			72.50	4.65	0.00	0.00	7.00	2.00	39.00	0.00	2.00	0.00	10.29	2.57	2.57	2.42
	PERCENTAGES				6.41	0.00	0.00	9.66	2.76	53.80	0.00	2.76	0.00	14.19	3.55	3.55	3.33
	TOTAL POINTS	31	AVE INTERVAL		1.76												
7	111	8.00A	15.50P	7.50 S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	2.50	0.00
7	111	12.00	12.00	2.50 L	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	111	12.00	12.00	10.00 L	0.00	0.00	0.00	2.00	0.00	3.00	2.00	3.00	0.00	0.00	0.00	0.00	0.00
7	112	8.50A	18.50P	10.00 S	2.86	0.00	0.00	0.00	1.43	2.86	1.43	0.00	0.00	0.00	0.00	0.00	1.43
7	113	11.00A	18.00P	7.00 S	0.00	0.00	0.00	0.00	0.00	1.17	2.33	2.33	0.00	0.00	0.00	0.00	1.17
7	113	12.00	12.00	7.00 L	0.00	0.00	0.00	0.00	0.00	3.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00
7	114	8.75A	17.50P	8.75 S	2.92	0.00	0.00	1.46	1.46	1.46	0.00	1.46	0.00	0.00	0.00	0.00	0.00
7	114	12.00	12.00	6.00 L	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	2.00	0.00	0.00
7	115	7.00A	17.50P	10.50 S	0.00	0.00	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	4.67	1.17	0.00
7	116	8.50A	16.00P	7.50 S	0.00	0.00	0.00	0.00	0.00	0.00	3.75	0.00	0.00	0.00	1.88	0.00	1.88
7	116	12.00	12.00	2.00 L	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
	PERIOD TOTAL SAMPLE			51.25 S	5.77	0.00	0.00	1.46	2.89	5.48	12.18	8.79	0.00	0.00	6.54	3.67	4.47
	PERIOD TOTAL LOGGED			27.50 L	0.00	0.00	0.00	2.00	0.00	8.50	12.00	3.00	0.00	0.00	2.00	0.00	0.00
	PERIOD TOTAL HOURS			78.75	5.77	0.00	0.00	3.46	2.89	13.98	24.18	11.79	0.00	0.00	8.54	3.67	4.47
	PERCENTAGES				7.33	0.00	0.00	4.39	3.67	17.76	30.70	14.97	0.00	0.00	10.85	4.66	5.68
	TOTAL POINTS	35	AVE INTERVAL		1.46												

FIGURE 3.8

SAMPLE OUTPUTS FROM EDIT PROGRAM

FIGURE 3.9

Input Editing Flow
(Weekly)



HYPOTHESES

SAMPLING VERSUS QUESTIONNAIRE DATA

The primary objective of the study was to compare the data collected via the self sampling approach (experiment data) with the data collected via the questionnaire approach (period estimates). Chapter two notes the problems and concerns over the reliability of the data collected via the questionnaire at the end of an academic period because it relies on recall over a period that is quite long. The first set of hypotheses addresses itself to the problem of reliability.

<u>Hypothesis 1.1</u> Experiment data equals period estimate: Twelve week estimates.

<u>Hypothesis 1.2</u> Experiment data equals period estimate: Six week estimates.

<u>Hypothesis 1.3</u> Experiment data equals period estimate: Three week estimates.

<u>Hypothesis 1.4</u> Experiment data equals period estimate: Aggregate.

<u>Hypothesis 1.5</u> Experiment data equals period estimate: Aggregate - No personal time work.

<u>Hypothesis 1.6</u> Experiment data equals period estimate: Aggregate - No administration.

The comparisons were made on eight of the major categories (i.e., research, preparation, department services, etc.) and in total.

The second set of hypotheses also addresses itself to the question of reliability of estimates. The pre estimates and the post estimates were both compared with the experimental data to determine if there were any significant differences. The comparisons were made

on eight of the major categories and the total.

Hypothesis 2.1 Pre estimates (estimates at the beginning of the quarter) equal experiment data.

Hypothesis 2.2 Post estimates (estimates at the end of the quarter) equal experiment data.

FEASIBILITY OF SELF SAMPLING

Another objective of the study was to evaluate the feasibility of using self sampling in a faculty environment.

Hypothesis 3.1 Self sampling is preferred to estimating methods for gathering data on faculty activities.

Hypothesis 3.2 A period of three to four weeks is about the right length of time for a faculty member to carry the device.

Hypothesis 3.3 Faculty members would rather carry the device for a short period of time with a higher frequency of points per day than to carry it for a longer period of time with a lower fequency of points per day.

Hypothesis 3.4 An average of one alarm per hour is a reasonable number of points per day.

FALL 1969 PARAMETERS VERSUS WINTER 1971 PARAMETERS USING CAMPUS

A final objective of the study was to analyze the effects of using the parameters developed from this study in the CAMPUS model compared with the outputs derived from the parameters that were based on the Fall quarter 1969 study.

Hypothesis 4.1 There is no significant difference between the CAMPUS outputs using Winter 1971 parameters versus using Fall 1969 parameters.

DATA ANALYSIS

DATA SUMMARIZATION AND TESTS OF SIGNIFICANCE

The data that came in weekly was summarized into major categories by faculty member by week. The weekly totals were summarized into a grand total for each faculty member. This report was given back to the faculty member for his own reference on how he allocated his time. The summary totals for each individual faculty member were used in the pairwise comparisons. The experiment data that was collected week by week over the quarter for each faculty member was compared with the period estimate at the end of the sampling period. These comparisons were made for eight categories and for the total. Class contact, evaluation and other instruction were not included in the comparisons. The comparisons were made in the following ways.

1. Period estimates versus experiment data (12 week).
2. Period estimates versus experiment data (6 week).
3. Period estimates versus experiment data (3 weeks).
4. Period estimates versus experiment data (Aggregate).
5. Period estimates versus experiment data (Aggregate - no personal time work).
6. Period estimates versus experiment data (Aggregate - No Administration).

In order to make the comparisons with the pre estimates and the post estimates, the means and variances for each three week period

(N = 18) were pooled to build the quarterly means and variances for each category using the experiment data. The following comparisons were made using this data:

1. Pre estimates versus experiment data (Aggregate).
2. Post estimates versus experiment data (Aggregate).

Personal time (work) and Personal time (other) were added categories needed for the sampling study to take care of observations that involved these activities when sampling. For the comparisons, personal time (other) was dropped completely. Personal time (work) was distributed across the other categories proportional to the amount of time in those categories. The assumption underlying this approach is that estimates made at the end of the period automatically include personal time (work) in them proportional to the amount of time in each category. One comparison was made with personal time (work) left out to see if this had any significant effect on the comparison.

All paired comparisons were done using a matched paired t-test.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2+S_2^2}{N} - \frac{2rS_1S_2}{N}}}$$

$\bar{X}_1$ = Experiment Data Mean

$\bar{X}_2$ = Period Estimates Mean

S_1 = Standard deviation of period estimates

S_2 = Standard deviation of sampling data

r = Correlation coefficient

N = Number of faculty in the comparison

The non paired comparisons of the experiment data with the pre estimates and the post estimates were done using the two sample t-test.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_p^2}{N_1} + \frac{S_p^2}{N_2}}}$$

Where

$$S_p^2 = \frac{(N_1-1)S^2_1 + (N_2-1)S^2_2}{N_1 + N_2 - 2}$$

$\bar{X}_1$ = Experiment data mean

$\bar{X}_2$ = Pre (or Post) estimate mean

S_p^2 = Pooled Variance

S_1^2 = Experiment data variance

S_2^2 = Pre (or Post) estimate variance

N_1 = Number of faculty for experiment data

N_2 = Number of faculty for pre (or Post) estimates

FEASIBILITY OF SELF SAMPLING

The data from the survey at the end of the quarter to assess the problems and feasibility of self sampling was summarized for each question. Percentages and weighted averages of scales were computed where appropriate.

CAMPUS EXPERIMENT

The data from the sampling study was used to replace the faculty parameters being used in the CAMPUS model. This was labeled as Project PRIME experiment number five. The parameters that were

being used were the parameters based on a study done by the Bureau of Institutional Research at the University of Minnesota for Fall quarter, 1969. Comparisons were made using the outputs derived from the two sets of parameters.

CHAPTER IV

EXPERIMENT SUMMARIZATION AND FINDINGS

DATA SUMMARIZATION

A total of 12,561 hours were classified into 43 different categories over the entire 12 week quarter. Of this amount, 869 hours were classified as personal time (other) netting 11,692 hours related to faculty activities. Personal time (work) amounted to 460 hours. This was spread back to the other activities proportional to the amount of time in those activities.

There were eighteen faculty that sampled each week. This consisted of one group of ten faculty that sampled the entire twelve weeks, two groups of four faculty that sampled each six week period and four groups of four faculty that sampled each three week period for a total of 34 faculty in the study.

The faculty had the option of sampling or logging. There were 6,992 hours sampled and 5,569 hours logged. There were 5,313 observations taken during the sampling hours for an average interval between observations of 1.31 hours. The hours sampled and logged are summarized by week in Table 4.1.

To avoid confusion, the terminology used in the following tables is described in Figure 4.1. The diagram shows the relationship of each data set to time. The data from each of the groups is shown in Table 4.2 distributed across the major categories. The data gathered via sampling and logging is referred to as the

Table 4.1

Experiment Data
Hours and Sample Points by Week

Week	Total Hours					Hours Without Personal Time Other			
	Sample Hours	Sample Points	Average* Interval	Logged Hours	Total	Sample Hours	Logged Hours	Total Hours	Average Hours N=18
1	689	534	1.29	369	1058	648	341	989	55.0
2	806	629	1.28	356	1162	772	330	1102	61.3
3	624	471	1.33	449	1073	602	424	1026	57.0
4	634	503	1.26	469	1103	592	437	1029	57.2
5	603	435	1.39	486	1089	568	465	1033	57.4
6	509	379	1.34	505	1014	491	470	961	53.4
7	627	499	1.26	530	1157	600	489	1089	60.5
8	678	506	1.34	446	1124	627	421	1048	58.3
9	569	448	1.27	486	1055	528	462	990	55.0
10	591	442	1.35	460	1052	556	422	978	54.4
11	416	304	1.37	570	986	386	447	833	46.2
12	245	163	1.50	443	688	232	382	614	34.1
Total	6992	5313	1.31	5569	12561	6602	5090	11692	54.1

*Sample Hours ÷ Sample Points

FIGURE 4.1

Definitions of Data Sets

(1) Pre-Estimates: Estimates for the 12 weeks at the beginning of the Quarter.

(2) Experiment Data: Self Sampling and Logged data by each group over the period sampled.

(3) Period Estimates: Estimates by each group over the period sampled.

(4) Post Estimates: Estimates for the 12 weeks at the end of the quarter.

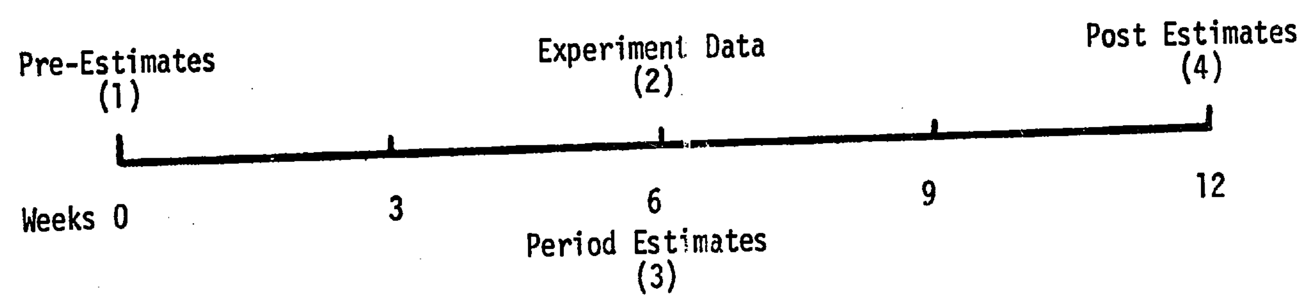


TABLE 4.2

EXPERIMENT DATA BY GROUP

Group		HOURS	L/S	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D
12 WEEK GROUP	TOTAL SAM	2632.43	S	203.77	88.71	65.03	261.71	133.47	393.12	228.90	432.19	123.26	587.79	114.46
	TOTAL LOG	1489.75	L	28.54	70.80	9.54	135.32	40.25	319.34	231.97	243.27	67.78	270.89	72.05
	GRAND TOTAL	4122.18		232.31	159.51	74.57	397.03	173.72	712.46	460.87	675.46	191.04	858.68	186.53
	PERCENTAGES			5.64	3.87	1.81	9.63	4.21	17.28	11.18	16.39	4.63	20.83	4.53
	TOTAL POINTS	2268		AVE INTERVAL	1.16									
6 WEEK GROUP (1)	TOTAL SAM	978.95	S	214.85	43.95	64.82	163.95	33.62	170.23	84.67	51.41	14.71	111.69	25.06
	TOTAL LOG	348.45	L	39.31	29.74	5.73	64.01	30.51	102.07	38.80	8.63	2.05	21.71	5.90
	GRAND TOTAL	1327.40		254.16	73.69	70.54	227.96	64.13	272.30	123.47	60.04	16.76	133.40	30.95
	PERCENTAGES			19.15	5.55	5.31	17.17	4.83	20.51	9.30	4.52	1.26	10.05	2.33
	TOTAL POINTS	640		AVE INTERVAL	1.53									
6 WEEK GROUP (2)	TOTAL SAM	856.92	S	148.84	75.59	31.76	183.61	27.24	178.20	29.65	119.16	14.19	17.63	31.05
	TOTAL LOG	576.67	L	32.64	136.66	14.57	95.12	9.69	93.81	31.42	71.12	5.76	17.28	68.59
	GRAND TOTAL	1433.59		181.48	212.25	46.34	278.73	36.93	272.02	61.07	190.28	19.95	34.91	99.64
	PERCENTAGES			12.66	14.81	3.23	19.44	2.58	18.97	4.26	13.27	1.39	2.44	6.95
	TOTAL POINTS	665		AVE INTERVAL	1.29									
3 WEEK GROUP (1)	TOTAL SAM	432.13	S	35.40	2.22	6.50	37.02	28.72	77.48	28.61	41.05	35.86	118.06	19.22
	TOTAL LOG	227.47	L	23.74	2.57	5.49	23.20	11.49	59.92	10.54	9.00	6.34	44.15	31.03
	GRAND TOTAL	659.60		59.14	4.79	13.99	60.22	40.21	137.40	39.15	50.05	42.20	162.20	50.25
	PERCENTAGES			8.97	.73	2.12	9.13	6.10	20.83	5.94	7.59	6.40	24.59	7.62
	TOTAL POINTS	361		AVE INTERVAL	1.20									
3 WEEK GROUP (2)	TOTAL SAM	364.66	S	36.07	26.02	26.59	50.49	15.65	87.97	9.38	41.92	9.69	34.94	25.94
	TOTAL LOG	275.08	L	17.92	18.18	1.56	22.07	11.95	122.91	16.36	21.55	2.08	23.37	17.14
	GRAND TOTAL	639.75		53.99	44.20	28.15	72.56	27.60	210.88	25.74	63.48	11.77	58.31	43.08
	PERCENTAGES			8.44	6.91	4.40	11.34	4.31	32.96	4.02	9.92	1.84	9.11	6.73
	TOTAL POINTS	327		AVE INTERVAL	1.12									
3 WEEK GROUP (3)	TOTAL SAM	441.22	S	69.31	17.77	28.24	79.69	27.39	62.98	13.42	29.09	12.44	74.36	26.54
	TOTAL LOG	261.42	L	17.55	7.23	7.07	60.32	4.39	72.28	7.23	3.87	3.61	33.04	49.82
	GRAND TOTAL	702.64		86.86	25.00	35.30	140.01	31.78	135.26	20.65	32.96	16.05	107.40	76.37
	PERCENTAGES			12.36	3.56	4.31	19.93	4.52	19.25	2.94	4.69	2.28	15.29	10.87
	TOTAL POINTS	352		AVE INTERVAL	1.25									
3 WEEK GROUP (4)	TOTAL SAM	362.20	S	39.49	90.90	24.80	90.63	6.49	8.47	11.11	31.24	4.89	33.30	20.88
	TOTAL LOG	170.08	L	7.83	36.67	.50	26.50	.83	92.25	0.00	1.50	0.00	0.00	4.00
	GRAND TOTAL	532.28		47.32	127.55	25.30	117.13	7.32	100.72	11.11	32.74	4.89	33.30	24.88
	PERCENTAGES			8.89	23.97	4.75	22.00	1.38	18.92	2.09	6.15	.92	6.26	4.67
	TOTAL POINTS	293		AVE INTERVAL	1.24									

experiment data. This is data set number three in Figure 4.1. The experiment data from the seven groups have been summarized for each week, for each three week period and for the quarter. The summary for the quarter is shown in Table 4.3.

Course work accounts for almost 19.2 hours per week of which 5.5 hours are direct contact hours. This is a ratio of 3.5 hours per contact hour. These figures are based on the full twelve weeks of the quarter including final week and quarter break. Extension is also included. Later in the chapter, extension is taken out to develop the parameters for CAMPUS.

Total instruction including other instruction (student research, exams, etc.) amounts to 21.4 hours per week. Research and public service account for 10.6 hours and 4.4 hours respectively. Administration is a big drain on faculty resources. Over thirteen hours a week is consumed in administration. The department heads and the dean are included in this data, however, even if they are taken out the average hours per week on administration is still over nine hours. Advising and miscellaneous student support services account for 1.5 hours per week, and professional development amounts to 3.1 hours. The total hours per week averages out to 54.0 based on a twelve week average. Figure 4.2 shows a breakdown of this data for each three week period. It is interesting to see how the category "institutional services" drops over the quarter. There is also a similar pattern for research. Preparation tends to be lower in the first part of the quarter and higher at the end. The same is true of evaluation.

TABLE 4.3

EXPERIMENT DATA-AGGREGATE

DISTRIBUTION OF HOURS ACROSS CATEGORIES

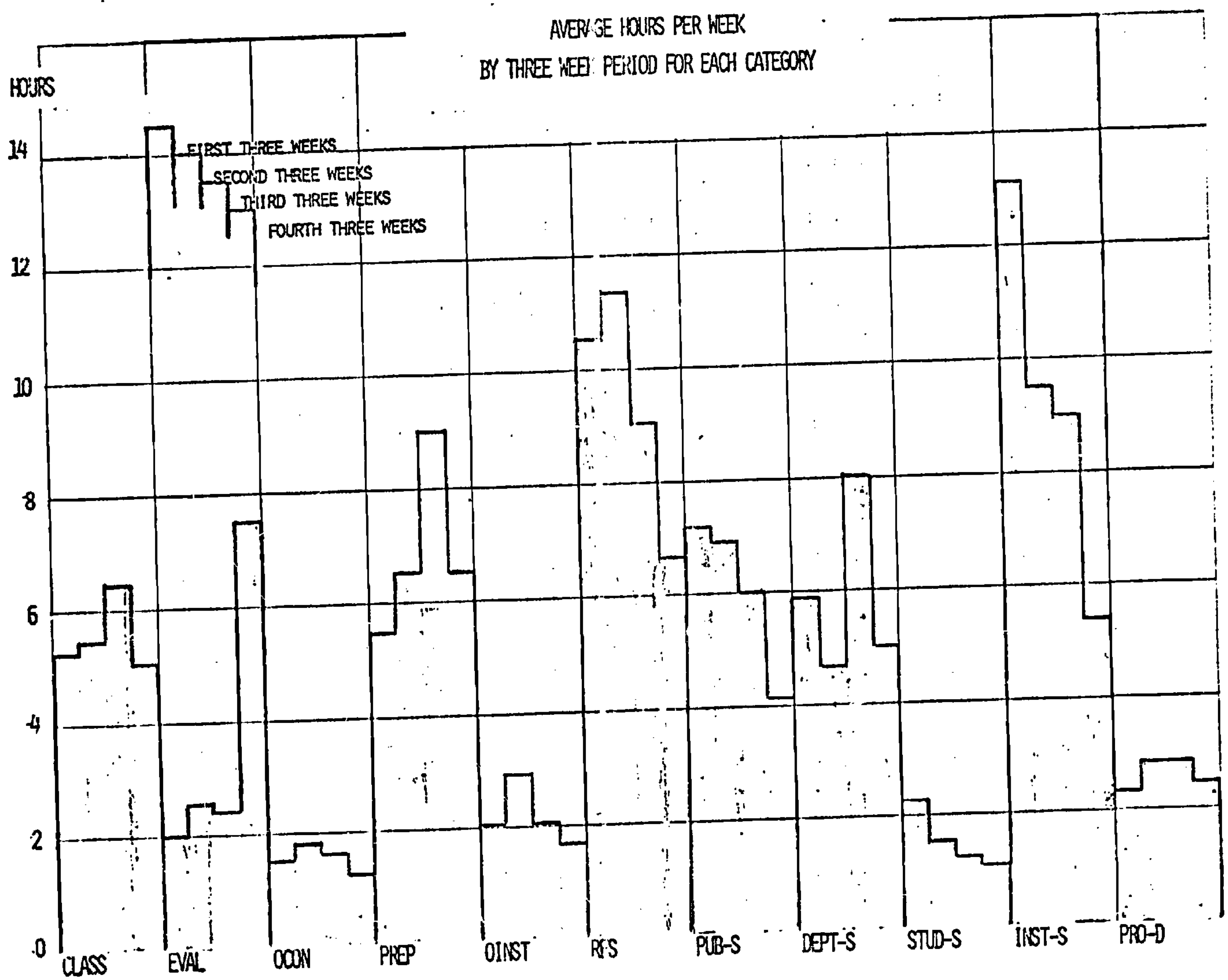
EXPERIMENT DATA AGGREGATE
N = 34 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2259.07	1642.74	764.30	3146.21	894.02	4302.51	1778.96	2054.69	605.31	3295.74	1252.14	22005.59
MEAN	66.44	48.32	22.48	92.54	26.29	126.54	52.32	60.43	17.80	96.93	37.12	647.23
AVE/WEEK	5.54	4.03	1.87	7.71	2.19	10.55	4.36	5.04	1.48	8.08	3.09	53.94
PER CENT	10.27	7.47	3.47	14.30	4.06	19.55	8.08	9.34	2.75	14.98	5.74	100.00

FIGURE 4.2

AVERAGE HOURS PER WEEK

BY THREE WEEK PERIOD FOR EACH CATEGORY



The jump in the last three weeks for evaluation is to be expected. A summary of the entire quarter in percentage form is shown in Figure 4.3.

Data was also gathered at the end of each period when a group finished sampling. Each faculty member was asked to estimate the number of hours that he spent in each category over the period he sampled. This data is called "period estimates" and is referred to as data set two in Figure 4.1. A summarization of this data is shown in Table 4.4. The three week groups and the six week groups have been adjusted to twelve week data by multiplying the six week data by two and the three week data by four. The average hours per week is close to 1.5 hours less than the experiment data in Table 4.3. The distribution of the hours is quite similar except for institutional services and public services which are both higher for the experiment data.

Another set of estimates was gathered at the beginning of the study. These were estimates on how the faculty thought they were going to allocate their time. This data has been labeled as pre estimates, and is referred to as data set one in Figure 4.1. Pre estimates were collected only on the faculty participating in the study. A summary of the data is shown in Table 4.5. A comparison of this data with the experiment data is shown in Figure 4.4. The largest differences are in research, other instruction, institutional services and professional development. The faculty in the study estimated they were going to spend close to twelve hours per week in research and ended up spending only about ten hours. Professional

FIGURE 4.3

DISTRIBUTION OF TIME TO CATEGORIES
PERCENTS

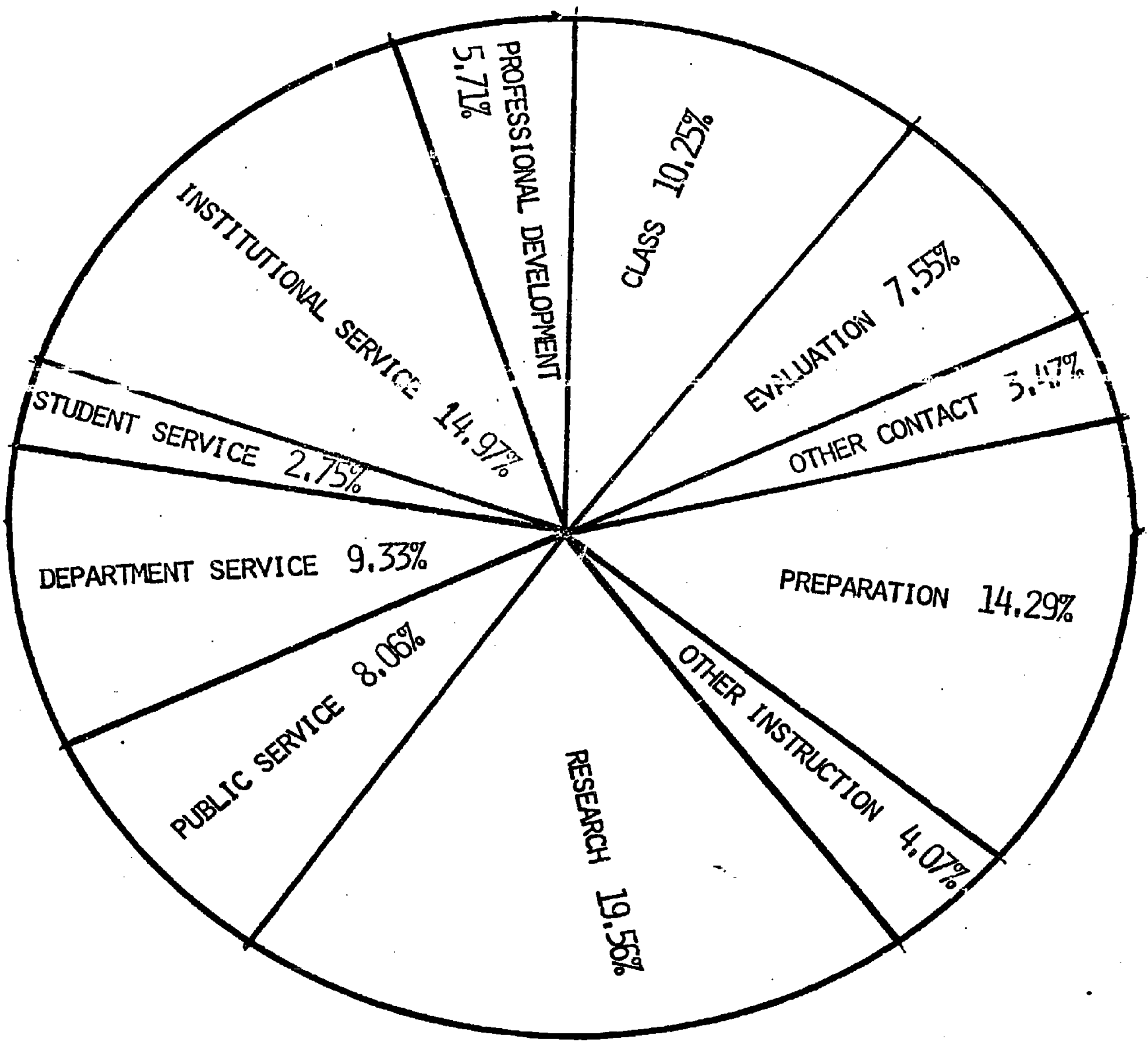


TABLE 4.4

PERIOD ESTIMATE DATA-AGGREGATE

DISTRIBUTION OF HOURS ACROSS CATEGORIES

PERIOD ESTIMATE DATA ALL GROUPS
N = 31 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	DCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2091.34	1481.70	768.88	2678.00	871.40	4028.96	1568.72	2070.70	432.12	2364.38	1242.92	19599.12
MEAN	67.46	47.80	24.80	86.39	28.11	129.97	50.60	66.80	13.94	76.27	40.09	632.23
AVE/WEEK	5.62	3.98	2.07	7.20	2.34	10.83	4.22	5.57	1.16	6.35	3.34	52.69
PER CENT	10.67	7.56	3.92	13.66	4.45	20.56	8.00	10.57	2.20	12.06	6.34	100.00

TABLE 4.5

PRE ESTIMATES

DISTRIBUTION OF HOURS ACROSS CATEGORIES

PRE ESTIMATES AGGREGATE QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

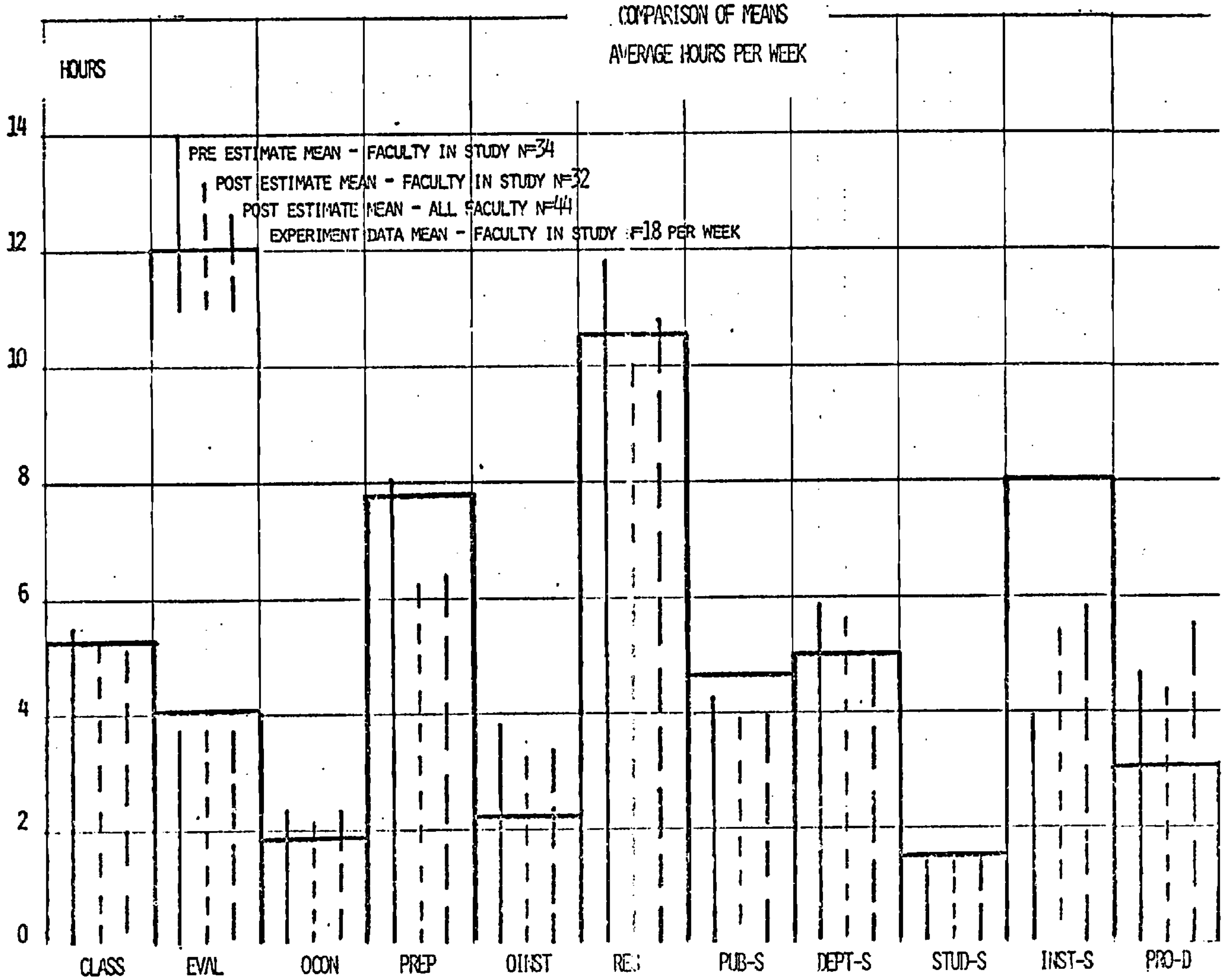
N = 34

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2236.00	1554.00	959.00	3263.00	1166.00	4790.00	1708.00	2377.00	572.00	1557.00	1877.00	22069.00
MEAN	65.76	45.71	28.50	95.97	34.29	140.88	50.24	69.91	16.82	45.79	55.21	649.09
AVE/WEEK	5.48	3.81	2.38	8.00	2.85	11.74	4.19	5.83	1.40	3.82	4.60	54.09
PER CENT	10.13	7.04	4.39	14.79	5.23	21.70	7.74	10.77	2.59	7.06	8.51	100.00

FIGURE 4.4

COMPARISON OF MEANS

AVERAGE HOURS PER WEEK



development was over estimated by about two hours. Institutional services was under estimated by four hours.

The last set of estimates were the estimates collected at the end of the quarter covering the entire quarter. These estimates are labeled post estimates, and are referred to as data set four in Figure 4.1. Post estimates were gathered on all faculty including teaching assistants. A summary of this data is shown in Table 4.6. The post estimates for the faculty in the study and for all faculty are also plotted on the chart in Figure 4.4. There is very little difference between the post estimates for the faculty in the study versus the aggregate of all the faculty. Figure 4.4 shows that all of the estimates stay quite close together. Consequently, the differences, between the post estimates and the experiment data follow the same pattern as the comparison with the pre estimates. The magnitude of the differences is not as great, however.

The reader should note that the data in this study reflects only the situation as it is perceived in a specific school in a specific university. Caution must be exercised in interpreting this data when using it for planning and decision making. The data must be interpreted in view of the definitions and procedures used in collecting it. This structure may not be appropriate for some decision making situations. The reader is further warned that the application of the methodology used in this study may need revision given a different set of objectives.

TABLE 4.6

POST ESTIMATES

DISTRIBUTION OF HOURS ACROSS CATEGORIES

POST ESTIMATES FACULTY IN STUDY
N = 32 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	1988.00	1471.00	837.00	2364.37	1216.00	3830.00	1500.00	2210.00	666.00	2183.00	1613.00	19878.37
MEAN	62.12	45.97	26.16	73.89	38.00	119.69	46.88	69.06	20.81	68.22	50.41	621.20
AVE/WEEK	5.18	3.83	2.18	6.16	3.17	9.97	3.91	5.76	1.73	5.68	4.20	51.77
PER CENT	10.00	7.40	4.21	11.89	6.12	19.27	7.55	11.12	3.35	10.98	8.11	100.00

POST ESTIMATES FACULTY NOT IN STUDY
N = 12 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	676.00	561.00	348.00	1022.00	555.00	1793.00	577.00	417.00	286.00	791.00	892.00	7918.00
MEAN	56.33	46.75	29.00	85.17	46.25	149.42	48.08	34.75	23.83	65.92	74.33	659.83
AVE/WEEK	4.69	3.90	2.42	7.10	3.85	12.45	4.01	2.90	1.99	5.49	6.19	54.99
PER CENT	8.54	7.09	4.40	12.91	7.01	22.64	7.29	5.27	3.61	9.99	11.27	100.00

POST ESTIMATES AGGREGATE ALL FACULTY
N = 44 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2664.00	2032.00	1185.00	3386.37	1772.00	5623.00	2087.00	2627.00	952.00	2964.00	2505.00	27797.37
MEAN	60.55	46.18	26.93	76.96	40.27	127.80	47.43	59.70	21.64	67.36	56.93	631.76
AVE/WEEK	5.05	3.85	2.24	6.41	3.36	10.65	3.95	4.98	1.80	5.61	4.74	52.65
PER CENT	9.58	7.31	4.26	12.18	6.37	20.23	7.51	9.45	3.42	10.65	9.01	100.00

POST ESTIMATES TEACHING ASSISTANTS
N = 25 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	1289.00	842.00	603.00	1233.00	0.00	0.00	0.00	199.00	0.00	0.00	0.00	4166.00
MEAN	51.56	33.68	24.12	49.32	0.00	0.00	0.00	7.96	0.00	0.00	0.00	166.64
AVE/WEEK	4.30	2.81	2.01	4.11	0.00	0.00	0.00	.66	0.00	0.00	0.00	13.89
PER CENT	30.94	20.21	14.47	29.60	0.00	0.00	0.00	4.78	0.00	0.00	0.00	100.00

FINDINGS AS THEY RELATE TO DIFFERENCES IN EXPERIMENT DATA VERSUS ESTIMATE DATA

Hypothesis 1.1 Experiment data equals period estimate data twelve week estimates.

Pairwise comparisons were made on the mean hours per quarter by category* between the experiment data and the period estimate data. The period estimate data for the 12 week group is the same as the post estimates on this group. The results of this comparison are shown in Table 4.7. The test statistic used for the comparison is the "t" distribution [See formula, p. 137]. The critical value of "t" for eight degrees of freedom at the five percent level of significance is 2.31. There were two categories where the hypothesis was rejected. Preparation time and time for institutional services were both higher than estimated. Research, professional development, and departmental services were less than the estimates, but not enough to be statistically significant. The mean total hours differs only by about 66 minutes per week.

Hypothesis 1.2 Experiment data equals period estimates; Six week estimates.

Pairwise comparisons on the six week groups between the experiment data and the period estimates were made in the same way as they were for the twelve week group. The results of this comparison

*All statistical tests exclude the categories of class contact, evaluation and other contact.

TABLE 4.7

EXPERIMENT DATA VERSUS PERIOD ESTIMATES - TWELVE WEEK GROUP

EXPERIMENT DATA 12 WEEK GROUP
N = 9 QUARTERLY TOTALS / AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	375.32	239.89	112.04	532.19	231.57	855.59	915.08	826.50	227.97	1457.07	238.92	6012.14
MEAN	41.70	26.65	12.45	59.13	25.73	95.07	101.68	91.83	25.33	161.90	25.55	668.02
AVE/WEEK	3.48	2.22	1.04	4.93	2.14	7.92	8.47	7.65	2.11	13.49	2.21	55.67
PER CENT	6.24	3.99	1.86	8.85	3.85	14.23	15.22	13.75	3.79	24.24	3.97	100.00
SD	34.66	25.54	12.00	40.19	20.42	101.77	99.76	83.45	28.37	198.74	18.36	136.48

PERIOD ESTIMATE DATA 12 WEEK GROUP
N = 9 QUARTERLY TOTALS / AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	356.00	203.00	128.00	366.00	318.00	1056.00	857.00	968.00	155.00	1107.00	376.00	5890.00
MEAN	39.56	22.56	14.22	40.67	35.33	117.33	95.22	107.56	17.22	123.00	41.78	654.44
AVE/WEEK	3.30	1.88	1.19	3.39	2.94	9.78	7.94	8.96	1.44	10.25	3.48	54.54
PER CENT	6.04	3.45	2.17	6.21	5.40	17.93	14.55	16.43	2.63	18.79	6.38	100.00
SD	36.05	19.77	14.13	23.28	28.98	126.49	116.74	110.86	11.21	164.62	32.61	157.50

$t(8)_{.05} = 2.31$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	2.15	4.10	-1.77	18.47	-9.60	-22.27	6.45	-15.72	8.11	38.90	-15.23	13.57
AVE/WK DIF.	.18	.34	-.15	1.54	-.80	-1.86	.54	-1.31	.68	3.24	-1.27	1.13
DIFF T				2.35	-1.09	-1.69	.50	-1.26	.86	2.94	-1.42	.28
CORRELATION	.90	.83	.94	.86	.47	.96	.95	.96	.21	.99	.30	.53

are shown in Table 4.8. The critical value of "t" for seven degrees of freedom at the five percent level of significance is 2.36. This hypothesis was accepted on all categories. There was one category that would have been significantly different at the ten percent level of significance. Departmental services was higher for the experiment data than for the period estimate. The total hours were also higher for the experiment data than it was for the estimates but not enough to be significant.

<u>Hypothesis 1.3</u> Experiment data equals period estimates: Three week estimates.

Pairwise comparisons were made between the experiment data and the period estimates for the three week groups. The results of this comparison are shown in Table 4.9. The critical value of "t" for thirteen degrees of freedom at the five percent level of significance is 2.16. The hypothesis was rejected for one category. Institutional services was significantly higher for the experiment data than it was for the estimates. Departmental services is significant at the ten percent level of significance but in an opposite direction.

<u>Hypothesis 1.4</u> Experiment data equals period estimates - Aggregate.

Pairwise comparisons between the experiment data and the period estimates were made after combining all groups. The results of this comparison are shown in Table 4.10. The critical value of "t" for thirty degrees of freedom at the five percent level of significance is 2.04. This hypothesis was rejected for one

TABLE 4.8

EXPERIMENT DATA VERSUS PERIOD ESTIMATES - SIX WEEK GROUP

EXPERIMENT DATA 6 WEEK GROUP
N = 8

	QUARTERLY TOTALS			AVE/WEEK BASED ON 12 WEEKS								
	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	865.12	555.50	232.98	994.28	202.98	1064.96	369.06	503.20	74.46	337.10	222.30	5421.94
MEAN	108.14	69.44	29.12	124.28	25.37	133.12	46.13	62.90	9.31	42.14	27.79	677.74
AVE/WEEK	9.01	5.79	2.43	10.36	2.11	11.09	3.84	5.24	.78	3.51	2.32	56.48
PER CENT	15.96	10.25	4.30	18.34	3.74	19.64	6.81	9.28	1.37	6.22	4.10	100.00
SD	48.11	55.93	19.22	56.31	36.47	72.14	29.88	56.70	8.53	39.09	26.54	156.16

PERIOD ESTIMATE DATA 6 WEEK GROUP
N = 8

	QUARTERLY TOTALS			AVE/WEEK BASED ON 12 WEEKS								
	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	854.82	327.02	233.84	1042.28	235.16	1195.12	283.96	337.06	83.64	273.74	280.32	5146.96
MEAN	106.85	40.88	29.23	130.28	29.39	149.39	35.49	42.13	10.45	34.22	35.04	643.37
AVE/WEEK	8.90	3.41	2.44	10.86	2.45	12.45	2.96	3.51	.87	2.85	2.92	53.61
PER CENT	16.61	6.35	4.54	20.25	4.57	23.22	5.52	6.55	1.63	5.32	5.45	100.00
SD	48.63	29.34	31.92	54.70	33.08	101.36	25.86	32.88	11.22	26.34	28.98	74.71

$t(7)_{.05} = 2.36$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	1.29	28.56	-.11	-6.00	-4.02	-16.27	10.64	20.77	-1.15	7.92	-7.25	34.37
AVE/WK DIF	.11	2.38	-.01	-.50	-.34	-1.36	.89	1.73	-.10	.65	-.60	2.86
DIFF T				-.34	-.91	-1.04	.80	2.20	-.23	.77	-1.02	.75
CORRELATION	.76	.76	.75	.61	.94	.93	.10	.96	-.05	.67	.74	.56

TABLE 4.9

EXPERIMENT DATA VERSUS PERIOD ESTIMATES - THREE WEEK GROUP

EXPERIMENT DATA 3 WEEK GROUP
N = 14 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	860.88	792.48	348.36	1364.64	370.12	1834.40	383.16	555.24	280.72	1372.04	665.08	8827.12
MEAN	61.49	56.61	24.88	97.47	26.44	131.03	27.37	39.66	20.05	98.00	47.51	630.51
AVE/WEEK	5.12	4.72	2.07	8.12	2.20	10.92	2.28	3.30	1.67	8.17	3.96	52.54
PER CENT	9.75	8.98	3.95	15.46	4.19	20.78	4.34	6.29	3.18	15.54	7.53	100.00
SD	29.93	82.81	22.49	62.99	22.82	102.53	37.83	32.78	22.78	94.69	35.07	114.09

PERIOD ESTIMATE DATA 3 WEEK GROUP
N = 14 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	880.52	951.68	407.04	1269.72	318.24	1777.84	427.76	765.64	193.48	983.64	585.60	8562.16
MEAN	62.89	67.98	29.07	90.69	22.73	126.99	30.55	54.69	13.82	70.25	41.90	611.58
AVE/WEEK	5.24	5.66	2.42	7.56	1.89	10.58	2.55	4.56	1.15	5.85	3.49	50.97
PER CENT	10.28	11.11	4.75	14.83	3.72	20.76	5.00	8.94	2.26	11.49	6.85	100.00
SD	31.76	78.41	26.67	47.09	21.24	99.84	42.25	47.11	15.36	75.59	35.91	124.47

$t(13)_{.05} = 2.16$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	-1.40	-11.37	-4.19	6.78	3.71	4.04	-3.19	-15.03	6.23	27.74	5.61	18.93
AVE/WK DIF	-.12	-.95	-.35	.57	.31	.34	-.27	-1.25	.52	2.31	.47	1.58
DIFF T				.82	1.24	.40	-.58	-1.99	1.19	2.17	.69	.71
CORRELATION	.76	.88	.66	.88	.87	.93	.87	.81	.53	.87	.65	.65

TABLE 4.10

EXPERIMENT DATA VERSUS PERIOD ESTIMATES - ALL GROUPS

EXPERIMENT DATA ALL GROUPS
N = 31 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2101.32	1587.87	693.38	2891.11	804.67	3754.95	1667.30	1884.94	593.15	3166.21	1126.30	20261.20
MEAN	67.78	51.22	22.37	93.26	25.96	121.13	53.78	60.80	18.81	102.14	36.33	653.59
AVE/WEEK	5.65	4.27	1.86	7.77	2.16	10.09	4.48	5.07	1.57	8.51	3.03	54.47
PER CENT	10.37	7.84	3.42	14.27	[illegible].97	18.53	8.23	9.30	2.88	15.63	5.56	100.00
SD	43.65	64.49	19.71	59.20	25.[illegible]5	93.92	67.17	59.76	22.23	129.67	30.41	130.04

PERIOD ESTIMATE DATA ALL GROUPS
N = 31 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2091.34	1481.70	768.88	2678.00	87[illegible].40	4028.96	1568.72	2070.70	432.12	2364.39	1242.92	19599.12
MEAN	67.46	47.80	24.80	86.39	2[illegible].11	129.97	50.60	66.80	13.94	76.27	40.09	632.23
AVE/WEEK	5.62	3.98	2.07	7.20	2.34	10.83	4.22	5.57	1.16	6.35	3.34	52.69
PER CENT	10.67	7.56	3.92	13.66	4.45	20.56	8.00	10.57	2.20	12.06	6.34	100.00
SD	44.64	58.00	25.43	54.36	26.54	105.52	73.55	72.25	13.10	104.92	32.36	122.52

$t(30)_{.05} = 2.04$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	.32	3.42	-2.44	6.87	-2.15	-8.84	3.18	-5.99	4.87	25.87	-3.76	21.36
AVE/WK DIF	.03	.29	[illegible]	.57	-.18	-.74	.26	-.50	.41	2.15	-.31	1.78
DIFF T				1.10	-.68	-1.22	.58	-.99	1.29	3.45	-.72	1.01
CORRELATION	.86	.82	.73	.82	.77	.92	.91	.89	.39	.95	.57	.57

category. Institutional services for the experiment data was significantly higher than for the estimates. The difference amounted to about two hours per week per faculty member. It is interesting to note that classroom contact for the two sets of data is only 20 minutes apart. This is less than two minutes per week.

Hypothesis 1.5 Experiment data equals period estimates: Aggregate - No personal time work.

Pairwise comparisons were made between the experiment data and the period estimates with personal time work excluded. Personal time (work) had been included and distributed over the other categories in proportion to the amount of time in that category for previous comparisons. The results of this comparison are shown in Table 4.11. Tables 4.11 and 4.10 represent the same comparisons with personal time (work) taken out of the experiment data in Table 4.11. The critical value for "t" for 30 degrees of freedom at the five percent level of significance is 2.04. The hypothesis was again rejected on the category institutional services. In the original comparison with personal time (work) included, six categories had a positive difference in means and five had a negative difference [Experiment mean minus Estimate]. Consequently, reducing the experiment data by taking out personal time (work) made the negative differences greater and the positive differences less. There was only one category that changed signs and this was classroom contact.

TABLE 4.11

EXPERIMENT DATA VERSUS PERIOD ESTIMATES

NO PERSONAL TIME (WORK)

EXPERIMENT DATA AGGREGATE NO PERSONAL TIME (WORK)
N = 31 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	1987.70	1505.34	647.43	2728.99	765.02	3608.78	1616.99	1796.28	558.78	3067.38	1072.21	19354.90
MEAN	64.12	48.56	20.88	88.03	24.68	116.41	52.16	57.94	18.03	98.95	34.59	624.35
AVE/WEEK	5.34	4.05	1.74	7.34	2.06	9.70	4.35	4.83	1.50	8.25	2.88	52.03
PER CENT	10.27	7.78	3.35	14.10	3.95	18.65	8.35	9.28	2.89	15.85	5.54	100.00
SD	41.42	60.68	18.31	55.72	24.11	40.61	66.84	57.77	21.73	129.48	28.93	131.53

PERIOD ESTIMATE DATA ALL GROUPS
N = 31 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2091.34	1481.70	768.88	2678.00	871.40	4028.96	1568.72	2070.70	432.12	2364.38	1242.92	19599.12
MEAN	67.46	47.80	24.80	86.39	28.11	129.97	50.60	66.80	13.94	76.27	40.09	632.23
AVE/WEEK	5.62	3.98	2.07	7.20	2.34	10.83	4.22	5.57	1.15	6.35	3.34	52.69
PER CENT	10.67	7.56	3.92	13.66	4.45	20.56	8.00	10.57	2.20	12.05	6.34	100.00
SD	44.64	58.00	25.43	54.34	26.54	105.52	73.55	72.25	13.10	104.92	32.36	122.52

$t(30)_{.05} = 2.04$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	-3.34	.76	-3.92	1.64	-3.43	-13.55	1.56	-8.85	4.09	22.68	-5.51	-7.88
AVE/WK DIF	-.28	.06	-.33	.14	-.29	-1.13	.13	-.74	.34	1.89	-.46	-.66
DIFF T				.27	-1.13	-1.78	.29	-1.47	1.10	3.08	-1.07	-.38
CORRELATION	.86	.82	.73	.80	.78	.92	.91	.89	.39	.95	.57	.59

Hypothesis 1.6 Experiment data equals period estimates: Aggregate - No Administration.

Pairwise comparisons were made between the experiment data and the period estimates leaving out faculty with heavy administrative assignments. The results of this comparison are shown in Table 4.12. The hypothesis was accepted on all categories and the total. The mean hours for the estimate data are higher on seven categories and lower on four. The average hours per week per faculty for the experiment data is 1.4 hours more than what was estimated.

Hypothesis 2.1 Pre estimates equal experiment data.

The experiment data was compared with the pre estimates on each category and the total. The two sample "t" test using a pooled variance was used as the test statistic [See formula, Chapter 3]. The means and the variances of the four 3 week sampling segments were combined to obtain an overall mean and variance for the experiment data. The results of the comparison are shown in Table 4.13. The critical value for "t" at the five percent level of significance with 50 degrees of freedom is 2.0. The hypothesis was rejected on two categories. Institutional services was significantly higher than estimated and professional development was significantly lower. The mean hours per week per faculty for the pre estimates was 54.09 compared with 53.94 using the experiment data. This is a difference of only ten minutes per week. The differences come in the distribution of these hours. Preparation and other instruction were over estimated.

TABLE 4.12

EXPERIMENT DATA VERSUS PERIOD ESTIMATES

NO ADMINISTRATION

EXPERIMENT DATA ALL GROUPS NO ADMINISTRATION
N = 26 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2011.08	1468.58	683.59	2660.51	761.94	3756.41	1400.11	1279.68	353.95	1604.50	1034.83	17015.19
MEAN	77.35	56.48	26.29	102.33	29.31	144.48	53.85	49.22	13.61	61.71	39.80	654.43
AVE/WEEK	6.45	4.71	2.19	8.53	2.44	12.04	4.49	4.10	1.13	5.14	3.32	54.54
PER CENT	11.82	8.63	4.02	15.64	4.48	22.08	8.23	7.52	2.09	9.43	6.08	100.00
SD	40.73	68.87	19.88	56.59	26.10	95.13	72.38	48.83	12.16	52.64	33.32	119.83

PERIOD ESTIMATE DATA ALL GROUPS NO ADMINISTRATION
N = 26 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2015.34	1389.70	719.88	2449.00	768.40	3632.96	1342.72	1499.70	345.12	1366.35	996.92	16576.12
MEAN	77.51	53.45	27.69	94.19	29.55	139.65	51.64	57.68	13.27	52.55	38.34	637.54
AVE/WEEK	6.46	4.45	2.31	7.85	2.46	11.80	4.30	4.81	1.11	4.38	3.20	53.13
PER CENT	12.16	8.38	4.34	14.77	4.64	22.22	8.10	9.05	2.08	8.24	6.01	100.00
SD	41.24	61.58	26.33	55.22	27.78	107.96	79.41	62.07	13.45	60.08	31.06	113.02

$t(25)_{.05} = 2.06$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	-.16	3.03	-1.40	8.13	-.25	2.83	2.21	-8.46	.34	9.15	1.46	16.89
AVE/WK DIF	-.01	.25	-.12	.68	-.02	.24	.18	-.71	.03	.75	.12	1.41
DIFF T				1.18	-.05	.23	.34	-.98	.10	.65	.27	.57
CORRELATION	.81	.82	.62	.80	.73	.82	.91	.71	.07	.18	.63	.39

TABLE 4.13

EXPERIMENT DATA VERSUS PRE ESTIMATES

EXPERIMENT DATA N = 34

	AGGREGATE QUARTERLY TOTALS			AVE/WEEK BASED ON 12 WEEKS								
	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2259.07	1642.74	764.30	3146.21	894.02	4[illegible]02.51	1778.96	2054.69	605.31	3295.74	1252.14	22005.69
MEAN	66.44	48.32	22.48	92.54	26.29	125.54	52.32	60.43	17.80	96.93	37.12	647.23
AVE/WEEK	5.54	4.03	1.87	7.71	2.19	10.55	4.36	5.04	1.48	8.08	3.09	53.94
PER CENT	10.27	7.47	3.47	14.30	4.06	19.55	8.08	9.34	2.75	14.98	5.74	100.00
SD	22.12	28.46	10.11	28.46	13.29	43.74	34.98	32.56	10.88	63.93	15.45	66.07

PRE ESTIMATES N = 34

	AGGREGATE QUARTERLY TOTALS			AVE/WEEK BASED ON 12 WEEKS								
	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2236.00	1554.00	969.00	3263.00	1166.00	4790.00	1709.00	2377.00	572.00	1557.00	1877.00	22059.00
MEAN	65.76	45.71	28.50	95.97	34.29	140.88	50.24	69.91	16.82	45.79	55.21	649.09
AVE/WEEK	5.48	3.81	2.38	8.00	2.86	11.74	4.19	5.83	1.40	3.82	4.60	54.09
PER CENT	10.13	7.04	4.39	14.79	5.28	21.70	7.74	10.77	2.59	7.05	8.51	100.00
SD	38.05	37.94	18.21	50.95	22.43	86.95	72.84	78.24	11.39	67.01	39.43	112.87
T-VALUE				-.34	-1.79	-.84	.15	-.65	.36	3.22	-2.47	-.08
												$t(50)_{.05} = 2.0$
MEAN DIFFERENCE												
DIFF MEAN	.68	2.61	-6.02	-3.44	-8.00	-14.34	2.09	-9.48	.98	51.14	-18.08	-1.86
AVE/WK DIF	.06	.22	-.50	-.29	-.67	-1.19	.17	-.79	.08	4.25	-1.51	-.16

Public service, student service, and institutional services were all under estimated.

Hypothesis 2.2 Post estimates equal experiment data.

The estimates at the end of the quarter were compared with the experiment data in the same way the pre estimates were compared. The results of this comparison are shown in Table 4.14. The critical value for "t" with 50 degrees of freedom is 2.0. The hypothesis was rejected on two categories. Preparation was over estimated and other instruction was under estimated. (Professional development was close to being significant at the five percent level.) The post estimate average total hours per week of 51.77 was lower than both the experiment data and the pre estimates by about 2.3 hours.

A summary of the findings as they relate to the differences between estimates and the experiment data are shown in Figure 4.5. The categories that were significantly different on the paired comparisons were institutional services, departmental services, and preparation. There were no significant differences on the totals. The differences on the aggregate - using the pre estimates and the post estimates were significant on preparation, other instruction, institutional services and professional development. The three week estimates and the six week estimates were very close to the experiment data indicating that estimating for these periods of time is fairly good. Estimates on the twelve week period were further from the experiment data. This is to be expected.

TABLE 4.14

EXPERIMENT DATA VERSUS POST ESTIMATES

EXPERIMENT DATA AGGREGATE
N = 34 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	2259.07	1642.74	764.30	3146.21	894.02	4302.51	1778.96	2054.69	605.31	3295.74	1262.14	22005.59
MEAN	66.44	48.32	22.48	92.54	26.29	126.54	52.32	60.43	17.80	96.93	37.12	647.23
AVE/WEEK	5.54	4.03	1.87	7.71	2.19	10.55	4.36	5.04	1.48	8.08	3.09	53.94
PER CENT	10.27	7.47	3.47	14.30	4.06	19.55	8.08	9.34	2.75	14.98	5.74	100.00
SD	22.12	28.46	10.11	28.46	13.29	48.74	34.98	32.56	10.88	63.93	15.46	66.07

POST ESTIMATES AGGREGATE
N = 32 QUARTERLY TOTALS AVE/WEEK BASED ON 12 WEEKS

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
SUM	1988.00	1471.00	837.00	2364.37	1216.00	3830.00	1500.00	2210.00	666.00	2183.00	1613.00	19878.37
MEAN	62.12	45.97	26.16	73.89	38.00	119.69	46.88	69.06	20.81	68.22	50.41	621.20
AVE/WEEK	5.18	3.83	2.18	6.16	3.17	9.97	3.91	5.76	1.73	5.68	4.20	51.77
PER CENT	10.00	7.40	4.21	11.89	6.12	19.27	7.55	11.12	3.35	10.99	8.11	100.00
SD	35.30	36.85	25.55	42.59	28.55	92.14	69.35	73.04	13.57	101.35	35.01	121.42
T-VALUE				2.10	-2.16	.38	.41	-.63	-1.00	1.39	-1.99	1.09

$t(50)_{.05} = 2.0$

MEAN DIFFERENCE

	CLASS	EVAL	OCON	PREP	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
DIFF MEAN	4.32	2.35	-3.68	18.65	-11.71	6.86	5.45	-8.63	-3.01	28.71	-13.28	25.03
AVE/WK DIF	.36	.20	-.31	1.55	-.98	.57	.45	-.72	-.25	2.39	-1.11	2.17

Figure 4.5

Summary of Differences for Each Hypothesis

Average Hours per Week

	PREF	OINST	RES	PUB-S	DEPT-S	STUD-S	INST-S	PRO-D	TOTAL
Hypothesis 1.1 Experiment Data vs Period Estimates (12 week)	$\boxed{1.54}$	.80-	1.86-	.54	1.31-	.68	$\boxed{3.24}$	1.27-	1.13
Hypothesis 1.2 Experiment Data vs Period Estimates (6 week)	.50-	.34-	1.36-	.89	$\underline{1.73}$	.10-	.66	.60-	2.86
Hypothesis 1.3 Experiment Data vs Period Estimates (3 week)	.57	.31	.34	.27-	$\underline{1.25-}$	.52	$\boxed{2.31}$	.47	1.58
Hypothesis 1.4 Experiment Data vs. Period Estimates (Aggregate)	.57	.18-	.74-	.26	.50-	.41	$\boxed{2.16}$	.31-	1.78
Hypothesis 1.5 Experiment Data vs Period Estimates (No Personal Time Work)	.14	.29-	1.13-	.13	.74-	.34	$\boxed{1.89}$	.46-	.66-
Hypothesis 1.6 Experiment Data vs Period Estimates (No Administration)	.68	.02-	.24	.18	.71-	.03	.76	.12	1.41
Hypothesis 2.1 Experiment Data vs Pre Estimates (Aggregate)	.29-	$\underline{.67-}$	1.19-	.17	.79-	.08	$\boxed{4.26}$	$\boxed{1.51}$	.16-
Hypothesis 2.2 Experiment vs Fost Estimates (Aggregate)	$\boxed{1.55}$	$\boxed{.98-}$	.57	.45	.72-	.25-	2.39	$\underline{1.11-}$	2.17

$\boxed{}$ = Significant at five percent level

____ = Significant at ten percent level

The post estimates in this study may have been better than in the typical survey because of the effect of the sampling study. Faculty were more aware of the time they were spending on various activities, because they were recording time throughout the quarter. Some faculty may have consciously or unconsciously used this data to aid them in their estimates. It should be noted, however, that there were only ten faculty (the twelve week group) that could have used data based on the entire quarter to assist them with their estimate. All of the other faculty would have only had partial data. The experiment data was not available to the faculty when they made the estimates. The only data that would have been available would have been notes they may have kept themselves.

One could challenge using "t" tests in performing the analysis in this study because of the dependence between categories. However, the assumption was made that this dependence becomes insignificant as the number of categories increase. With only three categories there would be high interdependence and only one "t" test would be appropriate. With eleven categories a significant difference in one category will not be highly dependent on a significant difference in another.

The analysis done in this study could be confounded by inconsistencies in the way faculty categorized their activity over the course of the study. There are two problems that exist: A faculty member could be inconsistant in categorizing a specific activity from one point in time to another point in

time; and there can be inconsistencies between faculty in categorizing the same activity. Based on (1) the post evaluation survey discussed in the next section [See Table 4.16], (2) spot checks made on activities where the faculty member specified the activity as well as categorized it, and (3) discussions with faculty on these problems, it appeared that neither problem was significant.

FINDINGS AS THEY RELATE TO THE PROBLEMS OF INTERPRETING CATEGORIES

A survey was conducted at the end of the study to assess the problems the participants had with interpreting categories. Reference Appendix C for an illustration of the form used in the survey. Tables 4.15 and 4.16 summarize the data obtained from this survey. Table 4.15 indicates that there were very few extreme problems with any category. The categories that had a higher percentage of responses to "some problems" versus "no problems" were (a) Student related research/other instruction, (b) Public Relations and services, (c) Student support services and (d) Professional development. The category with the largest weighting toward "some problems" was student support services. The other categories cited above were very close on their distribution of responses between "no problems" and "some problems". There tended to be some confusion between student support services, other contact and student related research. This is shown by Table 4.16 on activities 1.2, 1.4 and 1.8. Activity 1.2 (assisting a student with a term paper he is writing for a course you are presently teaching) should be classified as 14 (other contact), but there were a number that put it into 18 (student related research/other instruction).

Activity 1.4 (Preparing questions for a Ph.D. prelim) was spread over five different categories. It should have been classified as 18 (Student related research/other instruction). Activity 1.8

Table 4.15

Problems in Understanding Categories
N = 32

No Problems	Some Problems	Extreme Problems	
100%			Classroom Contact
93%	7%		Evaluation
52%	40%	8%	Other Contact
87%	13%		Preparation
40%	55%	5%	Student Related Research/Other Instruction
71%	26%	3%	Research and Scholarly Activity
48%	52%		Public Relations and Service

No Problems	Some Problems	Extreme Problems	
56%	41%	3%	Departmental Services
30%	67%	3%	Student Support Services
61%	39%		Institutional Services
47%	50%	3%	Professional Development
52%	42%	6%	Personal Time (Work)
68%	26%	6%	Personal Time (Other)

TABLE 4.16

DISTRIBUTION OF RESPONSES TO CATEGORIZING ACTIVITIES

N = 32

(%) DESIRED RESPONSE

ACTIVITIES / CATEGORIES	10 CLASSROOM CONTACT	12 EVALUATION	14 OTHER CONTACT	16 PREPARATION	18 STUDENT RELATED RESEARCH/ OTHER INSTRUCTION	20 RESEARCH AND SCHOLARLY ACTIVITY	30 PUBLIC RELATIONS AND SERVICE	40 DEPARTMENTAL SERVICES	50 STUDENT SUPPORT SERVICES	60 INSTITUTIONAL SERVICES	70 PROFESSIONAL DEVELOPMENT	80 PERSONAL TIME (WORK)	90 PERSONAL TIME (OTHER)
1.1 DISCUSSING WITH A PH.D. STUDENT THE PROS AND CONS OF ACCEPTING A TEACHING POSITION AT "X" INSTITUTION.			13		6				81				
1.2 ASSISTING A STUDENT WITH A TERM PAPER HE IS WRITING FOR A COURSE YOU ARE PRESENTLY TEACHING.		9	66		25								
1.3 DISCUSSING WITH A STUDENT HIS REGISTRATION FOR NEXT QUARTER.		3	6		3			3	85				
1.4 PREPARING QUESTIONS FOR A PH.D. ORAL EXAM.		23			41			18	9	9			
1.5 RIDING ON THE ELEVATOR ON YOUR WAY TO AN SBA FACULTY MEETING.								6		65	3	26	
1.6 TALKING IN THE HALLWAY TO ANOTHER PROFESSOR: 1 ABOUT YESTERDAYS HOCKEY GAME.												48	52
2 ABOUT THE ST. PAUL MOVE.							3			29	3	59	6
3 ABOUT PROBLEMS WITH A PARTICULAR COURSE YOU ARE TEACHING.	3	10	3	50	7							24	5
4 ABOUT A CURRENT RESEARCH PROJECT YOU ARE ENGAGED IN.						74					3	20	3
1.7 GRADING PAPERS FOR A CURRENT COURSE.		97	3										
1.8 TALKING TO A STUDENT FROM THE COLLEGE OF EDUCATION ON A TERM PAPER HE HAS IN AN EDUCATION COURSE.		7	10		33		3		40	7			
1.9 ON A TRIP TO INTERVIEW FOR A POSITION AT ANOTHER UNIVERSITY.											7		93
1.10 WRITING A TEXT BOOK.						100							
1.11 TRAVELING TO CHICAGO TO GIVE A TALK AT THE AMA CONVENTION.						13	53				20	7	7
1.12 ATTENDING THE DPMA CONVENTION IN TORONTO.							9			5	76	5	5
1.13 HAVING LUNCH WITH A PROSPECTIVE CANDIDATE FOR A POSITION AT THE BUSINESS SCHOOL.							3	33		55			3
1.14 ADVISING A STUDENT ON A PH.D. DISSERTATION TOPIC		10	3		71				13	3			
1.15 DIRECTING A FUNDED RESEARCH PROJECT.			3			88		3		6			
1.16 TRAVELING TO SCHOOL FROM HOME FOR CLASS IN THE MORNING.	8											22	70
1.17 TRAVELING TO SAN FRANSISCO ON A CONSULTING ASSIGNMENT.							76						24

indicates problems in this same area. Again, it should have been classified as 18 (Student related research/other instruction), but many responded as student support services. Activities 1.3 and 1.14 were also related to contact with students, however, these specific activities did not present problems. Activity 1.1 (Discussing with a Ph.D. student the pros and cons of accepting a teaching position at X institution) was also related to this same problem area. A few responded as 14 (other contact) and 18 (student related research and other instruction) but most of the responses were correctly identified with 50 (student support service).

There were some problems with personal time (work), personal time (other) and indirect time such as riding on an elevator. Most responded to activity 1.5 (riding on an elevator on your way to an SBA faculty meeting) by putting it into institutional services, since it was for a faculty meeting. However, a few regarded it as indirect time and classified it as personal time (work). Activity 1.6 (Talking about yesterday's hockey game) should have been classified as personal time (work), but many classified it as personal time (other). Traveling was another problem area. Some put traveling as part of the activity it was related to and others put traveling into personal time (other). This activity was not defined well. It is also a difficult one to decide on.

FEASIBILITY OF SELF SAMPLING

Data was gathered at the end of the study via a survey to obtain information regarding the use of self sampling compared to alternative methods. Information was also gathered on the length of time that appeared to be reasonable for a faculty member to carry the device, and the number of points per eight hour day that appeared to be an optimum, (i.e., a number that the faculty member could cope with).

One of the objectives of the survey was to assess how the participants would compare a self sampling system of collecting data with methods of estimating the data.

Hypothesis 3.1 Self sampling is preferred to estimating methods for gathering data on faculty activities.

Two questions in the survey were addressed to this hypothesis. The questions were essentially the same except one asked the faculty member to assume the data was collected every quarter and the other made the assumption that the data would be collected one quarter out of every six on random quarters. The distribution of responses is shown in Table 4.17. A weighted sum was calculated on each method by using a scale of -2, -1, 0, +1, +2 corresponding to the five cells going from "Strong Dislike" to "Strong Preference". The weighted sum makes it easier to compare the distribution of responses for each of the categories.

Table 4.17

Responses to Methods of Data Collection
N = 32

The following assumptions were made: Assume that a system were set up to record the time spent by faculty members on different activities. The system will be used by department heads and by individual faculty members to assist the planning process regarding activity allocation and loading.

ASSUME THAT DATA IS COLLECTED BY THIS METHOD EACH QUARTER FROM EVERY FACULTY MEMBER.

Strong Dislike	Indifferent			Strong Preference	Weighted Sum	
68%	14%	9%		9%	-40	Daily estimates
25%	28%	19%	28%		-16	Weekly estimates
37%	13%	37%	7%	6%	-22	Quarterly estimates
28%	9%	28%	26%	9%	- 7	Combination of sampling (using random beepers) and estimating (logging).
-2	-1	0	+1	+2	Weight Factor	

ASSUME THAT INPUT BY THIS METHOD IS COLLECTED ONE QUARTER OUT OF EVERY SIX ON RANDOM QUARTERS.

Strong Dislike	Indifferent			Strong Preference	Weighted Sum	
44%	16%	6%	22%	12%	-18	Daily estimates
19%	29%	16%	26%	10%	- 7	Weekly estimates
37%	20%	20%	17%	6%	-21	Quarterly estimates
22%	6%	15%	42%	15%	+ 7	Combination of sampling (using random beepers) and estimating (logging).
-2	-1	0	+1	+2	Weight Factor	

The data for both questions supports the hypothesis. The distribution of responses puts sampling first, weekly estimates second, and daily and quarterly estimates last. It is interesting to note that the method of quarterly estimates that is predominantly used is rated second to the last in the case of collecting data every quarter, and last if one were to collect data once every sixth quarter. This means daily estimates (logs or diarys) would be preferred to quarterly estimates. It is also interesting to note that the weighted sum is negative for every method except for using sampling one quarter out of every six on random quarters.

<u>Hypothesis 3.2</u> A period of three to four weeks is about the right length of time for a faculty member to carry the device.

The participants were asked to indicate what would be a reasonable length of time to carry the device during the quarter. The responses for this question are shown in Table 4.18. The data supports the hypothesis. There were about as many favoring five to six weeks as there were those favoring one to two weeks with the highest percentage favoring three to four weeks. One indicated zero weeks and four felt that ten weeks would be reasonable.

Another question was asked on how much time per quarter it would be worth for each faculty member to spend collecting data on how he allocates his time. Sixty five percent indicated one to three hours. The author estimates that sampling takes about an average of 30 seconds per observation to record. Assuming that 40 hours

Table 4.18

Responses to Questions Related to
Time Spent on Collecting Data
N = 32

How much time PER QUARTER do you feel would be WORTH spending PER FACULTY MEMBER in accounting for how he distributes his time.

____	4.1	Zero Hours	13%	4.4	3 - 6 Hours
19%	4.2	0 - 1 Hours	3%	4.5	6 - 12 Hours
65%	4.3	1 - 3 Hours	____	4.6	More than 12 Hours

Assume the device were carried one quarter out of every six. What would be a reasonable length of time to carry the device during the quarter.

3%	5.1	Zero Weeks	____	5.5	7 - 8 Weeks
22%	5.2	1 - 2 Weeks	3%	5.6	9 - 10 Weeks
35%	5.3	3 - 4 Weeks	9%	5.7	10 - 12 Weeks
28%	5.4	5 - 6 Weeks			

Which would be preferred.

87%	Sample 10 points per day over 20 days.
13%	Sample 5 points per day over 40 days.

Which seems to be an optimum number of sample points per eight hour period.

____	2	7%	6	17%	10	____	14
____	4	47%	8	12%	12	17%	16

per week would be sampled, with an average interval of 1.24 hours between points, there would be 32 points per week. This would account for 16 minutes per week. The author estimates that another 15 minutes per week would be required to log non-sampled time and to do miscellaneous administrative tasks in accounting for all cards during the week. Consequently, data collection via this method will take about 30 minutes per week. Three to four weeks could easily be sampled and not take up over three hours of time. This of course, does not account for the time of explaining to others what one is doing when the device beeps. However, this will soon fade away as a problem if the system were used periodically as a data gathering method.

Hypothesis 3.3 Faculty members would rather carry the device for a short period of time with a higher frequency of points per day than to carry it for a longer period of time with a lower frequency of points per day.

This hypothesis was supported very well. Eighty seven percent said they would rather sample ten points per day over 20 days rather than five points per day over 40 days.

Hypothesis 3.4 One alarm per hour is a reasonable number of points per day.

This hypothesis was partially supported. Forty seven percent indicated eight times per eight hour period. Forty six percent selected a higher number of points. The results to this question are shown in Table 4.18.

Another dimension of assessing the feasibility of using self sampling are the problems associated with the random signaler

device. The author was initially concerned over the loss of points due to devices being forgotten and the inability to hear the tone. Neither of these were a big problem in the study. All of the devices were set with an approximate mean interval between "beeps" of 60 to 90 minutes. The overall actual mean interval was 78 minutes. There were some points lost; however, the average was only about one point per faculty per week. This is based on an estimate of 70 minutes being the minimum mean of the mean time intervals of all the devices.

The survey at the end of the study also asked for information on problems of using the random signaler device. The results are shown in Table 4.19. The two categories with the highest percentage of extreme problems were the bulkiness of the unit and forgetting to carry it. Both of these problems can be solved by redesigning the device so that it can be worn like a wrist watch.

There were some problems with device reliability, but these problems can also be solved with a better device.

"Time consuming" does not appear to be a significant problem in using the device. Only 10 percent indicated extreme problems for this category, while over 50 percent indicated no problems.

The categories of "disturbing to others", "disturbing to you" and "hard to hear" are all related and received about the same distribution. There is a conflict in this situation. If the volume is turned up so that it is easier to hear, than it is more disturbing.

Table 4.19

Problems of Using the Sampling Device

N = 32

No Problems	Some Problems	Extreme Problems	
16%	65%	19%	Bulky to carry.
56%	37%	7%	Hard to hear.
47%	38%	15%	Disturbing to you.
23%	61%	16%	Forget to carry it.
61%	29%	10%	Time consuming.
45%	52%	3%	Disturbing to others.
67%	30%	3%	Device reliability.

The volume required depends on the environment. If the environment changes, then the volume should be changed. The device could be improved by having a volume control that could be set to fit the environment or the individual.

In summary, self sampling, given a less bulky device that can be conveniently carried, is a feasible means of gathering data on faculty given the following conditions.

1. Sample each faculty member for only three to four weeks.
2. Take about 8 to 10 observations per eight hour day.
3. Sample a faculty member no more than one quarter in every six on an average.

FINDINGS AS THEY RELATE TO THE CAMPUS MODEL EXPERIMENT

The two sets of parameters used for the CAMPUS experiment are shown in Table 4.20. The data from the Bureau of Institutional Research (BIR) study was restructured to come as close as possible to the structure of the Project PRIME study. The detail of this data is shown in Table 4.21. The data in this table came directly from the computer printout given to the Business School. The data from the Project PRIME study was taken from a summary of the experiment data that separated extension and put it into public service. The data from both studies was normalized to a base of fifty hours per week to derive the parameters for the study. The administration factor has been adjusted to allow for department heads at an extra fifteen hours per department head per week. This is why the total is 48.5 rather than 50.0. The total comes out to 50.0 at a base of sixty faculty of which six are department heads. This structure represents the base case.

It is interesting to note at this point how close some of the normalized factors are. Credit per contact hour for course activity, research, and administration are exactly the same. The differences are in other instruction, public service, professional development, and student services. Student services was not a category in the BIR study, consequently it shows up as zero. It is assumed by the author that faculty considered this category as part of administration (other)

Table 4.20

Faculty Parameters Used for the CAMPUS Experiment
(All data in weekly hours)

	Bureau of Institutional Research Study		Project PRIME Study	
	Actual	Normalized	Actual	Normalized
Contact Hours	5.1		4.5	
Credit Per Contact Hour Factor	4.3	3.6	3.8	3.6
Total Hours for Courses	21.7	18.3	17.3	16.0
Other Instruction	5.8	4.8	2.2	2.0
Research	11.8	9.9	10.9	10.0
Public Service	5.2	4.4	7.3	6.5
Administration*	13.3	9.8	12.0	9.8
Plus Per Department Head		15.0		15.0
Student Service			1.4	1.3
Professional Development	1.6	1.3	3.1	2.9
Total	59.4	48.5	54.1	48.5
Total with Dept. Head Administration		50.0		50.0

*Administration factors are based on 60 faculty and 6 Department heads.

48.5(60) + 15(6) = 3000

50(60) = 3000

TABLE 4.21

BUREAU OF INSTITUTIONAL RESEARCH

FACULTY ACTIVITIES STUDY

SCHOOL OF BUSINESS

FALL QUARTER, 1969

<u>INSTRUCTION</u>	
CLASS HOURS	5.1
PREPARATION	8.8
OTHER CONTACT	3.0
EVALUATION	4.8
	21.7
<u>OTHER INSTRUCTION</u>	5.8
<u>ADMINISTRATION</u>	
COURSE AND CURRICULUM DEVELOPMENT	2.1
DEPARTMENT, COLLEGE AND UNIVERSITY	3.7
OTHER ADMINISTRATION	4.2
OTHER--GENERAL	3.3
	13.3
<u>RESEARCH</u>	
SPONSORED AND DEPARTMENT	8.0
SCHOLARLY AND CREATIVE ACTIVITY	3.1
ADMINISTRATION OF RESEARCH	.7
	11.8
<u>PUBLIC SERVICE</u>	
PRESENTATION OF PAPERS	.9
PUBLIC SERVICE WITH COMPENSATION	2.8
PUBLIC SERVICE WITHOUT COMPENSATION	1.5
	5.2
<u>PROFESSIONAL DEVELOPMENT</u>	1.6
<u>TOTAL</u>	59.4

in the BIR study. The factor of fifteen additional hours for administration by department heads was based on the Project PRIME study.

A CAMPUS simulation was run using each parameter set. Cost center report 2.2 "Academic Staff Inventory by Rank" and 2.3 "Detailed Breakdown of Direct Activity and Non-Activity Load Amongst Academic Staff" were printed out for each of the six academic cost centers of the School of Business. These are Accounting, Finance and Insurance, Industrial Relations, Management Sciences, Management and Transportation, and Marketing and Business Law.

<u>Hypothesis 4.1</u> There is no significant difference between the the CAMPUS outputs using Winter 1971 parameters versus using Fall 1969 parameters.

The cost center reports for Fall quarter of the first year using each set of parameters are shown in Appendix K. A summary of the differences for Fall quarter of the first year and for Fall quarter of the second year are shown in Table 4.22. The dollar differences will follow the sample pattern as the parameter differences. A ten percent dollar difference using the PRIME study parameters as a base was set up as a criteria for determining a significant difference. The hypothesis is rejected on public services, professional development and student support. By year three the hypothesis is also rejected on research.

Table 4.22

Comparison of Outputs from the CAMPUS Experiment
(Quarterly Costs in Thousands of Dollars)

	Year 1						Year 3					
Cost Center	Instr	Admin	Res	Pub-S	Pro-D	Stud-S	Instr	Admin	Res	Pub-S	Pro-D	Stud-S
Accounting												
BIR Parameters	43	10	8	4	1	-	50	14	12	5	2	-
PRIME Parameters	42	9	8	5	2	1	50	16	14	9	4	2
Finance and Insurance												
BIR Parameters	22	10	9	4	1	-	28	15	14	6	2	-
PRIME Parameters	21	10	9	6	2	1	27	17	16	10	5	2
Industrial Relations												
BIR Parameters	19	14	12	5	2	-	23	14	13	6	2	-
PRIME Parameters	19	14	12	8	4	2	22	16	14	9	4	2
Management Science												
BIR Parameters	24	15	13	6	2	-	28	18	17	7	2	-
PRIME Parameters	24	15	13	8	4	2	27	20	19	12	5	2
Management and Transportation												
BIR Parameters	45	13	11	5	2	-	49	20	18	8	2	-
PRIME Parameters	44	13	11	7	3	1	45	22	21	14	6	3
Marketing and Business Law												
BIR Parameters	19	15	13	6	2	-	24	14	12	5	2	-
PRIME Parameters	19	15	14	9	4	2	24	14	13	8	4	2
Total												
BIR Parameters	172	77	66	30	10	-	202	95	86	37	12	-
PRIME Parameters	169	76	67	43	19	9	199	105	97	62	28	13

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

SUMMARY OF THE STUDY

IMPETUS FOR THE STUDY

THE PROBLEMS: Chapter I discussed the problems higher education is facing. These problems include dynamic student growth rates, rising costs, program expansion, increasing complexity of the systems and a growing dissatisfaction with the outputs. The growth of students from 1940 to 1960 was 2 million students an increase of 133 percent. Student enrollments are estimated to climb to 10.3 million in 1980 an increase of 194 percent over the 1960 enrollment of 3.5 million.

Increasing costs during this same period have compounded the problem. The cost per student index rose 55 points during the ten year period from 1955 to 1967, while the consumer price index rose less than 20 points. The combination of these two factors, numbers of students and cost per student both climbing rapidly have put higher education into a crisis situation.

Other factors are also adding to the problem. Proliferation of specialized programs to meet the needs of growing problems in our society are adding to the costs. Many of these programs have high start up costs and low numbers of enrollees. Consequently, the cost per student is high. Coordinating bodies are attempting to control these programs to eliminate duplication within reasonable geographic limits.

Probably one of the biggest factors adding to the overall problem is the increasing complexity of higher education systems. Universities have become very complex systems. There are hundreds of subsystems and hundreds of interfaces that make up the system. Coupled with this there is a complex form of management (i.e., president, vice presidents, deans, department heads, committees, and faculty) that is involved in the process of distributing resources. This structure is complex because of the number of people, objectives and sub-objectives involved. In order to contend with these systems, universities must look toward more sophisticated management tools. Systems analysis, information systems, planning, programming, budgeting systems, and simulation are techniques that can help define and structure the university system so that it can be managed and controlled. These techniques will aid in defining the relationships between inputs and outputs of the system, so that university management can make decisions regarding resource allocation that will produce outputs compatible to the objectives and goals of the institution. Aggregate costs of inputs will be broken down and associated with outputs so that decision making can proceed on the basis of cost per output as well as cost per input.

THE IMPORTANCE OF FACULTY ACTIVITY ANALYSIS: Implementing systems to aid the decision making process in higher education requires that data be collected, maintained and transformed so it can support the decisions that are to be made. Data on how faculty

time is allocated to the various programs and processes of higher education represents the key factor. Over eighty percent of the resources used in the primary academic areas are in support of faculty and staff activities. Consequently, decisions on alternatives depend a lot on how it affects the draw on faculty resources. Analysis on faculty activities is currently done in many forms across the country. Most studies use surveys where the faculty estimate the amount of time they feel they spend on various activities. There are many problems with these studies.

1. Activity Definitions
2. Measures of Faculty Activities
3. Population problems
4. Acceptance by the faculty
5. Accuracy of data collection methods

This study is concerned primarily with the last problem. There is a general concensus among faculty and administrators that the estimating done is not accurate enough to be useful for planning models and systems to support the decision making process in higher education. The purpose of this study was to explore a self sampling method of collecting data on faculty and determine if there are significant differences between the data collected via sampling and the data collected via estimating. Another purpose of the study was to assess the feasibility of using self sampling as a method of collecting data.

BACKGROUND OF THE STUDY

The study was conducted as a part of Project PRIME (Planning

Resources in Higher Education). Project PRIME was a one year project to test implement the CAMPUS simulation model in three institutions of higher education in Minnesota. Parameters relating faculty time to activities are key variables in the CAMPUS model. Consequently, Project PRIME provided a unique environment to integrate a study on data collection relating to faculty activities.

THE STUDY

Thirty four faculty from the School of Business at the University of Minnesota participated in the study. They were asked to complete five tasks as a part of the study.

1. Estimate at the beginning of the quarter the time they thought they would spend on each activity throughout the quarter [Pre-Estimates].
2. Sample their time over a period of the quarter [Experiment Data]. Ten faculty sampled all twelve weeks, four faculty sampled the first six weeks, four faculty sampled the last six weeks, and sixteen faculty sampled four at a time for three weeks covering the entire quarter.
3. Estimate at the end of the period the time they spent on each activity over the period sampled [Period Estimates].
4. Estimate at the end of the quarter the time they spent on each activity over the entire quarter [Post Estimates].
5. Complete a survey pertaining to their reactions on using self sampling.

The sampling study was conducted using a random signaler device

that would "beep" at random times during the day. The faculty member carrying the device recorded what he was doing at the time of the beep. The total time that the faculty member sampled during any sampling segment was distributed into the categories proportional to the number of points in each category. Time spent on faculty activities not sampled was accounted for by logging the hours into each category.

FINDINGS AND CONCLUSIONS

The data obtained from the experiment (experiment data) showed that the faculty in the study spent an average of 19.2 hours per week over the twelve weeks on course related activities. Of this, 5.5 hours were spent in class, yielding a ratio of 3.5 hours spent for every contact hour produced. Another 2.20 hours were spent in other instruction, such as graduate papers, graduate exams, and independent study. Research and public service averaged 10.56 hours and 4.35 hours per week respectively for a total of 14.91 hours. Administration consumed close to the same amount of time. Department duties averaged 5.04 hours per week while services to the institution (School of Business or the University) averaged 8.08 hours per week for a total of 15.49 hours. Professional development averaged 3.08 hours per week, and services to students such as advising and general support of student activities consumed 1.48 hours per week.

The study showed that estimates made by the faculty can come very close to the data derived through self sampling on many categories. However, there were some categories where significant differences occurred. See Figure 5.1. Preparation showed up significantly different in comparing the data derived through self sampling with the estimates at the end of the period for the twelve week group and on the aggregate post estimate comparison. Other instruction

Figure 5.1

Summary of Categories with Significant Differences

	Experiment Data Mean Hours Per Week	Estimate Mean Hours Per Week
Hypothesis 1.1		
(Experiment versus period estimate - 12 week)		
Preparation	4.93	3.39
Institutional Services	13.49	10.25
Hypothesis 1.2		
(Experiment versus period estimate - 6 week)		
No Significant Differences		
Hypothesis 1.3		
(Experiment versus period estimate - 3 week)		
Institutional Services	8.17	5.85
Hypothesis 1.4		
(Experiment versus period estimate - Aggregate)		
Institutional Services	8.51	6.36
Hypothesis 1.5		
(Experiment versus period estimate - No personal time work)		
Institutional Services	8.25	6.36
Hypothesis 1.6		
(Experiment versus period estimate - No administration)		
No Significant Differences		
Hypothesis 2.1		
(Experiment versus Pre estimates)		
Institutional Services	8.08	3.82
Professional Development	3.09	4.60
Hypothesis 2.2		
(Experiment versus Post estimates)		
Preparation	7.71	6.16
Other Instruction	2.19	3.17

showed up as a problem category on the post estimate comparison.

There was a problem with estimating time spent on professional development that appeared when the data derived from self sampling was compared with the aggregate quarter estimates. This category was significantly over estimated for the pre estimates and was very close to being significant for the post estimates.

The category that was the most difficult to estimate was institutional services. This category was significantly under estimated on all of the estimates. The only time this category did not show up as significant at the five percent level was when faculty with administrative assignments were left out (the six week groups had no faculty with administrative assignments) or when the comparison was made on an aggregate basis with the post estimates. One explanation for this is that as faculty become more involved with administrative assignments, they have more difficulty in estimating their time. Administrative tasks are so varied and they are sandwiched into smaller segments of time than the tasks in other categories. Consequently, the administrative categories are more difficult to estimate.

The study also showed that self sampling can be used in a faculty environment. The acceptance of any method of collecting data is, of course, relative to the acceptance of collecting the data in the first place. Overall the faculty indicated a preference for using self sampling rather than estimating. Weekly estimates were the next preference, with daily and quarterly estimating as the last preference.

The structure that appears to be more feasible for incorporating self sampling in a faculty environment is to (a) Sample each faculty for not more than three to four weeks at a time, (b) Take one observation for every 40 to 60 minutes on an average, and (c) Sample random quarters such that any one faculty member does not sample more than once every sixth quarter.

In summary, self sampling can be used as an effective means of gathering data to either derive faculty parameters, or to check on systems that do derive these parameters.

It has been shown that estimating can differ significantly from the data derived from self sampling on some categories. Consequently, parameters derived from estimates must be used with caution, and cannot be used with confidence when they are used in planning models.

Self sampling can be an inexpensive and convenient method of increasing the reliability and confidence in the parameters being used. This will in turn increase the confidence of the faculty in the planning process.

IMPLICATIONS FOR FURTHER RESEARCH

More research should be done to develop a standard system of collecting data on faculty activities. The system should be continuous so that it becomes part of the faculty member's routine. This does not mean he is putting input into the system every quarter, but that he can expect to submit input during some quarters on a systematic basis. A continuous system will also keep faculty acquainted with category structures so that this problem will not be as significant. Another advantage of a continuous system is the ability to look at the behavior of parameters with respect to time. Are Fall quarter parameters significantly different than Winter or Spring quarter parameters? Are there trends in the parameters? Can these trends be associated with changes in the technology of instruction?

The main problem is determining an optimum system of collecting this data. What mix of estimating and sampling should be used? Should time reports be maintained for certain types of tasks such as research projects, committee assignments and similar assignments?

Another problem area that needs more research is a standardized set of category definitions that will be adaptable to institutions across the nation. This will help reduce the problems of interpreting definitions because they will not change for every study that comes along, and it will make it possible to summarize program structures beyond the institutional level. Perhaps the work presently being done by WICHE will solve this problem.

APPENDIX A

PROJECT PRIME REPORT
NUMBER 2

Project PRIME Report No. 2

An Introduction to Project PRIME and CAMPUS MINNESOTA

David C. Cordes

November 1970

Project PRIME Research Coordinated by the
Minnesota Higher Education Coordinating Commission

An Introduction to Project PRIME and CAMPUS MINNESOTA

I. BACKGROUND

PRIME is an acronym for Planning Resources in Minnesota Education. Project PRIME is a one year project jointly funded by the Minnesota State College System, Minnesota Junior College System, the University of Minnesota, the Hill Family Foundation, and the Minnesota Higher Education Coordinating Commission. The project's primary objective is the test implementation of CAMPUS (Comprehensive Analytical Methods for Planning University Systems) in one State College (Bemidji - Behavioral Science Division), in one Junior College (Lakewood) and in one school at the University of Minnesota (School of Business Administration).[1]

The CAMPUS model was developed under a Ford Foundation Grant by the Institute for Policy Analysis in the University of Toronto. The Institute has an extensive research program entitled "Systems Analysis for Efficient Resource Allocation in Higher Education." The program consists of six integrated projects: (1) Program Planning and Budgeting in Universities, (2) Planning and Financing Higher Education, (3) Models for University Planning (CAMPUS), (4) Integrated University Information Systems, (5) Models for planning and use of physical facilities, and (6) Planning and Management Systems for University Information Resource Centers.[2]

Because of the Ford Foundation Funding, the CAMPUS model is available to the public. The latest version available to the public is known as CAMPUS-V.[3] CAMPUS V was programmed on an IBM 360/85 computer. CAMPUS-MINNESOTA, hereafter called "CAMPUS-M", is identical to CAMPUS V except that it is operational on the University of Minnesota's CDC 6600 Computer.[4]

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[1] For further information on the Project see "Test Implementation of CAMPUS (A Computer Based Simulation Model) for Higher Education Administration and Planning in Minnesota", February 1970. Project PRIME Report No. 1 March 1970.

[2] For a description of each project, their objectives, and their status at the end of 1969 see Judy, Richard W. "A research progress report on Systems Analysis for efficient resource allocation in higher educations", University of Toronto, January 1, 1970, 24 pp.

[3] Another version or CAMPUS, labelled either CAMPUS VI or CAMPUS-CONNECT is available from the Systems Research Group (SRG). SRG is a corporation whose principles are former associates of the Institute for Policy Analysis. CAMPUS VI is available in an interactive mode, and costs approximately $50,000 per installation.

[4] For futher details see Milton S. Fisher and Patrick Davitt, "Converting CAMPUS V to CAMPUS-MINNESOTA", (Project PRIME report No. 11)

II. INPUTS

CAMPUS-M is a resource simulation model with an ability to "represent reality" in considerable detail. As an indication of the level of detail, let's examine the data needed for a single course (or activity):

(1) Staff - academic e.g. professor and academic support e.g. teaching assistant.
(2) Space - classroom, instruction lab, or special lab.
(3) Teaching equipment - projectors, bunson burners, computers, etc.
(4) Type of course - lecture, lab.
(5) Staff Specialization - accounting, philosophy, art, etc.
(6) Schedule time - hours per session and sessions per week.
(7) Success factor - probability of completing courses with a passing grade.

Exhibit 1 provides a listing of the types of input required by CAMPUS-M. These sections are examined briefly below.

DEFINE: This section "defines" or structures the institution's programs and cost centers (departments). Exhibit 2 is a program structure for a typical School of Business Administration and Exhibit 3 is a corresponding cost center structure.

ACTIVITY: Activities are primarily courses. Resources required for each course were discussed above.

PROGRAM: Activities (courses) are related to programs (degrees), through the use of participation rates. Also established are the length of the degree programs - 2 years, 4 years, etc.; and the number of credits needed for graduation.

STUDENT: Actual entering students both freshmen and advanced standing students are input in this section. Drop-outs and transfers from major to major are also entered in this section.

STAFF AND XSTAFF: Staffing units required for each teaching and non-teaching duty are entered here; plus salary and office space. Hiring and promotion policy variables are also part of this input.

SPACE AND AVLSPACE: There are four types of space in this section: classroom, instructional labs, special labs, and service department space. Operating costs, construction costs and service characteristics (e.g. air-conditioning) are also needed.

SERVICE: Inputs are needed for staff, space, cost, and equipment associated with service departments.

EQUIPMENT: Cost and type of teaching equipment

REVENUE: By source and use

MISCELLA: Forms for developing miscellaneous resources, e.g. benefits, travel expenses.

III. PROCESS

(A) INSTRUCTION PROGRAM: A schematic of the use CAMPUS-M makes of the input data for the instructional programs is shown on Exhibit 4. The process begins with students entering the system as shown on the left.[5/] They enter, either as freshmen or advanced standing students and select a program (or major). Each program in CAMPUS has a curriculum. A curriculum is defined for each quarter, and for each study level (Junior, Senior) as: "a set of activities (courses) and a set of participation rates". The participation rates for an activity represent the probability that students in this program and in this quarter will select this activity. The combination of curriculum, program, and students determines a demand on activities. The resources required to "teach" these activities (e.g. staff, equipment space) are drawn from the cost centers or departments.

(B) SUPPORT PROGRAMS: Developing resources for the support programs involves using the concept of a service department. A typical example of a service department is the computer center. To determine the "supplies" (one resource type) needed for this department, CAMPUS-M can use a relationship of the following type:

Computer Center Supplies = \$20,000 + \$100 per student
+ \$500 per faculty member
= \$20,000 + \$100(100) + \$10(500)
= \$35,000

The number of students and faculty "drawing" supplies from the computer center for any quarter would be determined from the instruction process, as explained above. CAMPUS-M refers to the "per student" and the "per faculty member in the above equation as the "functional basis". The 49 functional bases available in the model are shown on exhibit 5. Note from the exhibit that one basis is "(1)" or the absolute amount (the \$20,000 in the example). A maximum of three functional bases can be used for each resource at each cost center (or program). The use of functional bases gives the model-builder a very flexible vehicle for determining resources in support programs.

(C) RESEARCH AND PUBLIC SERVICE PROGRAMS: If the research or public service activity is carried on by a specified organization e.g. MISRC or department, e.g. single quarter leave; determination of required resources can be handled analogously to those for support programs. If the research or public service is a "faculty activity", CAMPUS-M develops the required resources using a non-teaching duty category. Two possibilities are available: (1) Using a fixed % of faculty time or (2) using the "functional basis" on a resource called "staffing units".

[5/] An inventory of students in the system at start-up is a required input.

IV. OUTPUT

There are three major groupings of output reports available in the present version of CAMPUS-M: (1) Input Data reports, (2) Cost Center reports and (3) Over-Time reports. The first group of reports are provided to collate the input information and develop it in a logical report format, thus facilitating an examination of the input data. There are 44 report formats (exhibit 6) available in 9 major categories as follows:

INPUT DATA REPORTS

Report Category	Description	Number of Report Formats
1	Program Structures and Departments	4
2	Activities	6
3	Programs and Students	4
4	Staff	7
5	Space	7
6	Space	6
7	Service Departments	4
8	Revenue	4
9	Miscellaneous Resources	2
		44

The second group of reports, the "COST CENTER Reports", are provided to aid the institution's managers e.g. department heads, deans, etc. The present version of CAMPUS-M has seven major report types and 48 report formats (Exhibit 7) as follows:

COST CENTER OUTPUT REPORTS

Report Category	Description	Number of Report Formats
1	Students and enrollees	2
2	Staff	5
3	Equipment	2
4	Service	2
5	Space	19
6	Space	8
7	Summary	10
		48

A third group of available reports are called "OVERTIME Reports". These reports are for a session (year) as contrasted with the preceeding two groups which are "Single period (Quarter)" reports. Up to 10 sessions are possible. Five categories of reports are available (Exhibit 8):

OVERTIME REPORTS

Report Category	Description	Number of Report Formats
1.1	Student and Enrollee Load	1
1.2	Staff Costs	1
1.3	Space Requirements	1
1.4	Operating Costs	1
1.5	Summary Report	1
		5

V. ANALYSIS WITH CAMPUS-MINNESOTA

As with all simulation models, "its real value depends on the ability of the user to recognize situations in which the model can be used and to devise alternatives for investigation."[6] The developers of CAMPUS suggest five different problem areas where the model may be a valuable tool for analysis:[7]

1. SCALE OF OPERATIONS - Problems in this area are mainly concerned with the impact of altering the levels at which various programs are carried out. Typical investigations would assess the impact of changing student enrollment or student graduation goals.

2. GENERAL STRUCTURAL DECISIONS - Structural decisions occur on two levels. The first of these concerns the composition of the institution itself in terms of the educational and research programs that are pursued by the university. The second level of structural decisions occurs within the program level and is concerned with the activity composition of the program. Alterations of this kind involve adding or deleting particular activities.

3. PEDAGOGICAL DECISIONS - A number of decisions relating to activities have to be made with respect to the way in which they are going

[6] Systems Research Group, Seminar on University Administration, March 17 and 18, 1969.

[7] Ibid.

to be carried out. For instructional activities these might include class sizes, the type, qualifications and mixture of staffing to be used, and teaching equipment (ETV, CAE) requirements.

4. ADMINISTRATIVE DECISIONS - The various activities place loads on the cost centers or departments and these departments have a number of administrative decisions that must be made. Such matters as professional staffing policy, use of support staff, renumeration and tenure policy and various other financial and administrative questions need to be assessed.

5. GENERAL POLICY - General policy decisions can be characterized as university level administrative decisions. Such matters as a change in the semester system, addition of new schools and faculties, and the introduction of new scheduling techniques are representative of the kinds of decisions faced at this level.

VI. RESEARCH IN PROGRESS[8]

(A) PROGRAM COSTING: Although impressive, the output reporting capability of CAMPUS-M suffers from a major weakness - the available reports are for cost centers only and not programs (exhibit 2). The essence of program budgeting is to report resources (and of course, effectiveness) by "programs". Exhibit 10 is one example of a desirable program report. It shows "total" resource requirements for a typical program element e.g. Ph.D. degree in MIS. Other reports providing "unit" cost, e.g. per degree, per credit hour, etc., are also planned. Fortunately, most of the basic data needed for "program costing" is generated and available in the model. Two reports are in progress explaining Project PRIME's efforts in this area.[9]

(B) RESOURCE ANALYSIS MODELS IN HIGHER EDUCATION:[10] The research being conducted in this area involves a synthesis and analysis of four resource analysis models: (1) CAMPUS; (2) Program Budgeting; (3) Leontief's input-output analysis; and (4) Linear programming. Each model will first be individually explained, followed by a theoretical synthesis using the input/output framework as the key integrating structure.

To ascertain the value of structuring the data as proposed above,

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[8] Exhibit 9 is a bibliography of Project PRIME reports.

[9] Davitt, Patrick Program Accounting with CAMPUS-M, unpublished master's thesis (Also available as Project PRIME report Number 8) and Gary M. Andrew and David C. Cordes, Program Costing and Resource Analysis with CAMPUS-MINNESOTA: A Philosophic note, Project PRIME report Number 5 in progress.

[10] David C. Cordes Resource Analysis Models in Higher Education, Project PRIME report No. 10 in progress.

an analysis will be conducted using test data from the three institutions involved in Project PRIME. To facilitate this analysis we have a computer program known as "EL FYD". The model's peculiar name stems from its association with the Department of Defense's Five Year Defense Program (FYDP).[11] Physically the model consists of two groups of computer codes - one a "generalized cost model" in input/output format and the second a "report generator" that provides flexibility in writing tables; both for staff analysis, and management reporting.

An analysis of the usefulness of the proposed synthesis for improving and integrating planning for various levels of a statewide education system e.g. departments within colleges, is planned.

(C) ANALYSIS OF FACULTY ACTIVITIES:[12] Faculty resources represent a major portion (77% in SBA, University of Minnesota 69-70) of the total variable input in higher education. Of this amount only a small percentage (class time) is easily measured. The remaining amount is difficult to measure due to the large range of activities, the number of activities involved with at any one time, and the varied working schedule of the faculty. Current attempts to measure these activities using questionnaires do not appear to be sufficiently accurate. Research will be done to explore the accuracy of the questionnaire, and the feasibility of using activity self sampling to improve current methods of data collection. Activity self sampling is a process of recording activity engaged in at random points over a period of time. This is done with the aid of a small random alarm device carried by the individual to signal the points.

If the data collected via a questionnaire proves to be too inaccurate for use in resource allocation models, then further work will be necessary to develop systems that will provide the desired accuracy.

(D) FACULTY ACTIVITY INFORMATION SYSTEM:[13] Information systems and resource allocation models in higher education require coordinated subsystems. These subsystems include (see exhibit 12): (1) input subsystems, (2) the data base management subsystem, and (3) analysis and reporting subsystems. Work must be done on defining the various subsystems so that

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11/ The FYDP is the "programming" system associated with the Department of Defense's Planning, Programming, and Budgeting System (PPBS). For a detailed explanation of PPBS see Cordes, David C. Planning, Programming, and Budgeting Systems in Education: Concept, Operation, Status, and a School of Business Administration Example, Research Monograph No. 1, Management Information Systems Research Center, May 1970, 68 pp. (Also available as Project PRIME Report No. 4)

12/ For further information on this research see Lorents, Alden C. Analysis of Faculty Activities for Resource Allocation Models, Project PRIME Report No. 6, in progress.

13/ For further information on this research see Lorents, Alden C. A Faculty Activity Information Subsystem and CAMPUS-MINNESOTA, Project PRIME Report No. 7

there is compatibility:

(1) with the WICHE[14] data element definitions
(2) with the Resource Analysis Model
(3) with the Data Processing Systems.

The proposed faculty activity information system to be designed in this research project will consider the campatibility as noted above. The design will include definitions of the input system, data elements, file design and outputs. It will also include definitions to interface the data elements in the subsystem with CAMPUS.

(E) CURRICULUM COST/BENEFIT ANALYSIS[15] Research is needed on a methodology for performing a cost benefit analysis on an academic curricula. The CAMPUS model is ideally suited for the costing side. However, little work has been done in the area of educational outputs. In a recent paper presented before the WICHE-MIS conference on educational outputs, David Brown sketched out a framework for an educational output index.[16] At the present time it appears that placing a dollar value on an educational output is infeasible, however Brown's index approach is very promising. The index approach will not tell administrators how well they are doing in absolute terms but it will allow them to see how they are doing with respect to the past and it will allow them to compare expenditures with a quantifiable measure of output.

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[14] WICHE is Western Insterstate Commission in Higher Education. The MIS section is working on defining information systems in higher education.

[15] For further information see Fisher, Milton S. "A Curriculum Cost-Benefit Analysis," Project PRIME Report No. 9, in progress.

[16] Brown, David G. "A Scheme for Measuring the Output of Higher Education," Outputs of Higher Education: Their Identification, Measurement, and Evaluation, Papers from a seminar held at Washington, D.C., May 3-5, 1970, conducted by the Western Interstate Commission for Higher Education in cooperation with the American Council on Education and the Center for Research and Development in Higher Education at Berkeley, Edited by Ben Lawrence, George Weathersby, and Virginia W. Patterson, July 1970.

Exhibits Index

Exhibit 1

Level 1 Command INPUT

Index of Level 2 and Level 3 Command INPUT Documents

LEVEL 2	LEVEL 3	
DEFINE	01	Institution Name and Simulation Time Factors
	02	Cost Center Levels
	03	Cost Centers
	04	Program Levels
	05	Programs
	06	Program to Cost Center Affiliation
ACTIVITY	01	Activity Type
	02	Specialty Type
	03	Schedule Range
	04	Section Size Range
	05	Resource Combinations
	06	Activities
	07	Exception Activities
	08	Exception Resources
PROGRAM	01	Program Curricula
	02	Curricula Activities and Participation Rates
	03	Program Duration and Enrolment Update
	04	Credits Per Credit Range by Program
STUDENT	01	New Entrants to Institution with NO Academic Credit
	02	Distribution of New Entrants with NO Academic Credit
	03	New Entrants with Academic Standing
	04	Student Transitions
	05	Student Credit Load
STAFF	01	Academic Staff Ranks
	02	Academic Staff Activity Teaching Duties
	03	Academic Staff Activity Non-teaching Duties
	04	Academic Support Staff
	05	Non-academic staff
XSTAFF	01	Detailed Academic Staff Ranks
	02	Detailed Academic Staff Activity Teaching Duties
	03	Detailed Academic Staff Activity Non-teaching Duties
	04	Detailed Academic Staff Inventory, Transition and Hiring Criteria
	05	Detailed Academic Staff Optimization and Update Policies
SPACE	01	Classroom Sizes (stations)
	02	Laboratory Sizes (stations)
	03	Classroom Space Planning Factors
	04	Classroom Type Characteristics
	05	Instructional Lab. Space Planning Factors
	06	Instructional Lab. Type Characteristics
	07	Special Lab. Space Planning Factors
	08	Special Lab. Type Characteristics
	09	Service Space Characteristics by Type
	10	Cost Center Space Characteristics
	11	Service Code Specifications
	12	Space Category Codes, Names, Construction, and Maintenance Costs

	13	Miscellaneous Space Specifications
	14	Teaching Space Control Centers
AVLSPACE	01	Available Classroom Space
	02	Available Instructional Laboratory Space
	03	Available Instructional Special Laboratory Space
	04	Available Space by Category
SERVICE	01	Service Departments and Affiliations
	02	Service Staff
	03	Service Space
	04	Service Equipment
EQUIPMEN	01	Equipment Resource Characteristics
REVENUE	01	Characteristics of Revenue
	02	Revenue at Cost Centers
	03	Revenue at Programs
	04	Revenue of Service Departments
MISCELLA	01	Miscellaneous Resource Characteristics
	02	Miscellaneous Resource by Cost Center
RESEARCH *		
INREPRT	01	Input Report Controls
	02	Comments
UTREPR	01	Output Report Control-Cost Centers
	02	Output Report Control-Program

General Experiment Coding Sheet

* To be available

Exhibit 2

A Program Structure
for a
School of Business Administration

PRIMARY
- 1.0 INSTRUCTION
  - 1.1 Undergraduate
    - BSB Accting
    - BSB Regular
  - 1.2 Graduate
    - Master of Business Administration (Day)
    - Executive Master of Business Administration (Evening)
    - Master of Arts - Industrial Relations
    - Ph.D. - (10 program elements)1/
    - Master of Science - (10 program elements)1/
- 2.0 RESEARCH
  - 2.1 Organized Research
    - Center for Experimental Study of Business (CESB)
    - Industrial Relations Center (IRC)
    - Management Information Systems Research Center (MISRC)
  - 2.2 Department Research
    - Summer Research
    - Department Research
- 3.0 PUBLIC SERVICE
  - Continuing Business Education
  - Bureau of Business Research
  - Faculty Public Service

SUPPORT
- 4.0 ACADEMIC SUPPORT
  - Computer Center
  - Industrial Relations Library
  - Business Reference Library
  - Department Administration and Committees
  - Professional Development
- 5.0 STUDENT SUPPORT
  - Pre-Business Counseling
  - Graduate Studies
  - Placement
  - Student Support - Faculty
- 6.0 INSTITUTION SUPPORT
  - College Administration
  - Administrative Services
  - Committees - College Wide

1/Each element is a degree major: Accounting, Finance, Industrial Relations, Management, Management Information Systems, Marketing, Production, Quantitative Analysis, Insurance, and Transportation.

Exhibit 3

Cost Center Structure
for a School of Business Administration

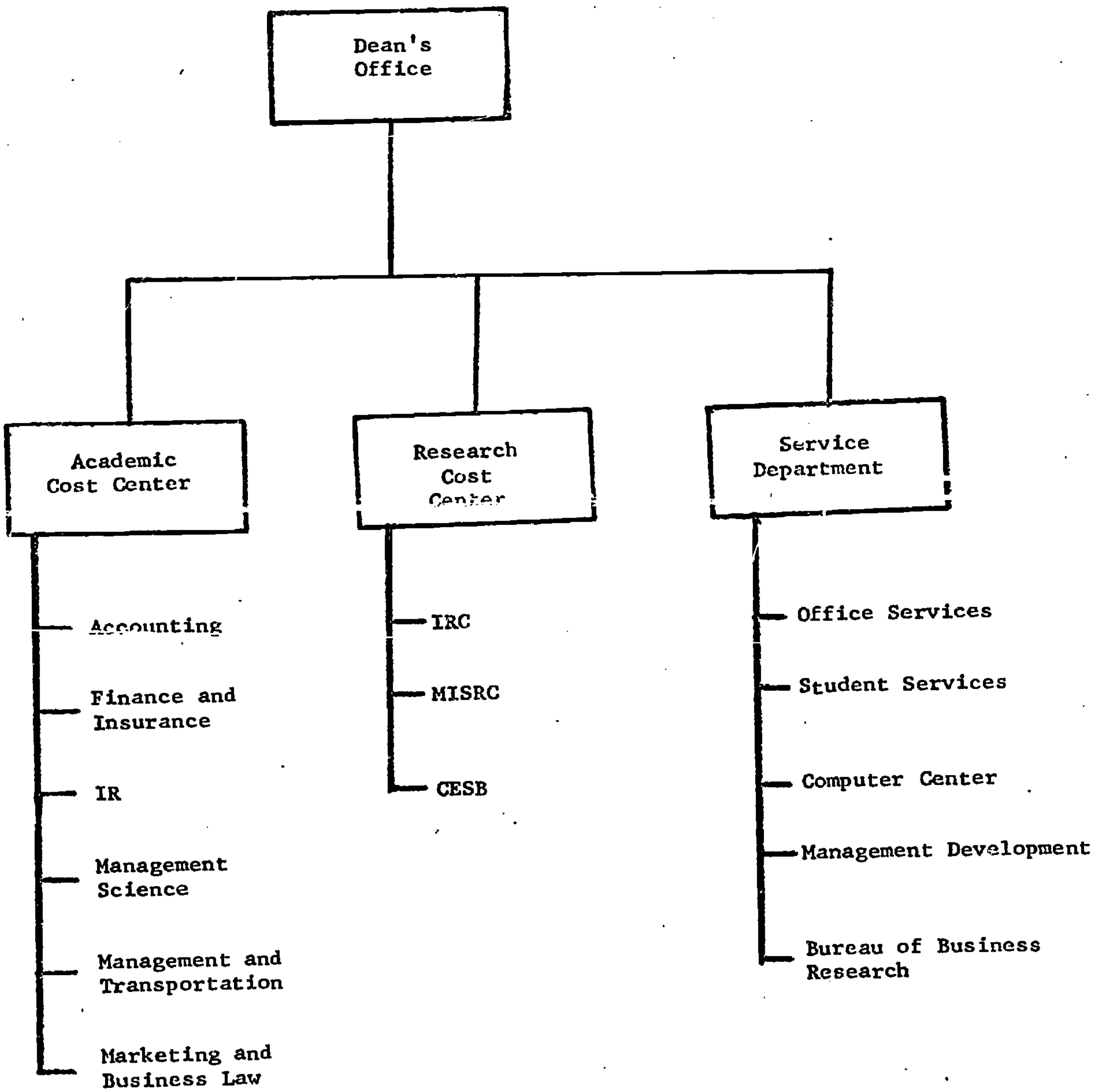
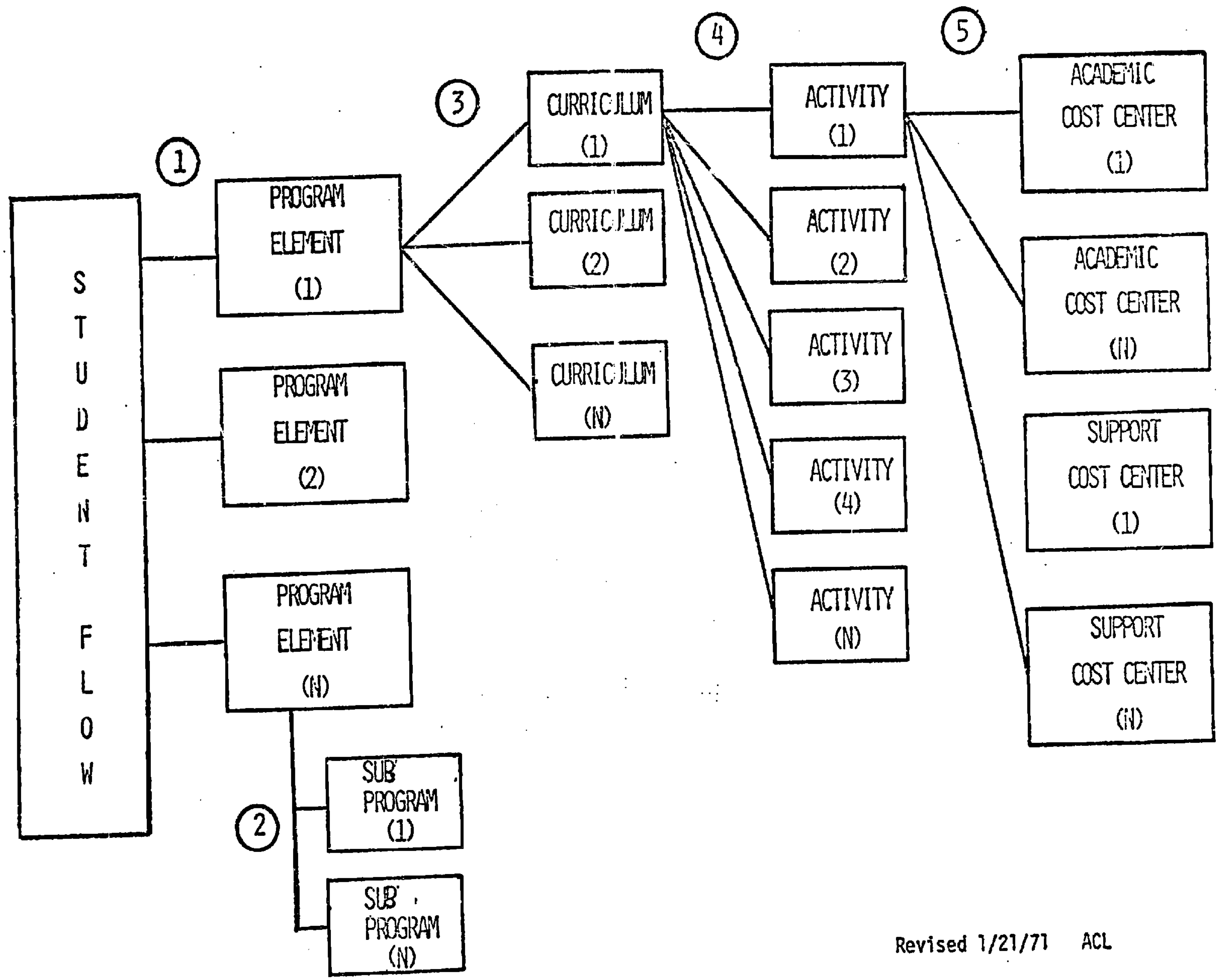


Exhibit 4

STUDENT FLOW/ACTIVITY/RESOURCE DEMAND PROCESS



Revised 1/21/71 ACL

Exhibit 5

FUNCTIONAL BASES FOR THE CALCULATION OF INDIRECT RESOURCES AT A COST CENTER[1/]

Code Number	Description
1.	Absolute - value 1.0
2.	Affiliated students
3.	Affiliated enrollees
4.	Enrollee load
5.	Aggregate affiliated students
6.	Aggregate affiliated enrollees
7.	Aggregate enrollee load
8.	Number of academic staff
9.	Number of academic support staff
10.	Number of non-academic staff
11.	Total staff at the cost center
12.	Aggregate number of academic staff
13.	Aggregate number of academic support staff
14.	Aggregate number of non-academic staff
15.	Aggregate total staff
16.	Number of affiliated programs
17.	Aggregate number of affiliated programs
18.	Classroom space
19.	Laboratory space
20.	Total space
21.	Aggregate classroom space
22.	Aggregate laboratory space
23.	Aggregate total space

Exhibit 5 (continued)

Code Number	Description
24.	Operating costs
25.	Aggregate operating costs
26.	Number of directly affiliated cost centers
27.	Absolute - Value 0.1
28.	Absolute - Value 0.01
29.	Absolute - Value 10.0
30.	Absolute - Value 100.0
31.	Absolute - Value 1000.0
32.	Total academic staff salaries
33.	Total academic support staff salaries
34.	Total non-academic staff salaries
35.	Total full time academic staff hired
36.	Total staff salaries
37.	Aggregate academic staff salaries
38.	Aggregate academic support staff salaries
39.	Aggregate non-academic staff salaries
40.	Aggregate total salaries
41.	
42.	Affiliated students in 100's
43.	Affiliated enrollees in 100's
44.	Enrollee load in 100's
45.	Aggregate affiliated students in 100's
46.	Aggregate affiliated enrollees in 100's
47.	Aggregate enrollee load in 100's
48.	Number of stations in a room
49.	Number of square feet in a room

1/ Aggregate = Total at a cost center considering all the affiliated cost centers below the referenced cost center.

Exhibit 6

Input Data Reports

Report No.	Title and Contents

1.0 PROGRAM STRUCTURES AND DEPARTMENTS

1.1 SIMULATION CHARACTERISTICS: Institution name, Simulation periods per session, Length of simulation period, and Comments on this run.

1.2 COST CENTERS - LEVEL/NODE STRUCTURE: The levels, nodes and nodes of affiliation of the cost centers reflecting the flow of funds and resources.

1.3 PROGRAMS - LEVEL/NODE STRUCTURE: The levels, nodes and nodes of affiliation of the programs, reflecting the flow of teaching resources.

1.4 AFFILIATION OF PROGRAM NODES TO COST CENTER NODES: Program nodes affiliated to cost center nodes reflecting the flow of funds and resources to the programs.

2.0 ACTIVITIES

2.1 ACTIVITY CHARACTERISTICS: Activity and specialty types.

2.2 ACTIVITY CHARACTERISTICS-SCHEDULE AND SECTION SIZE RANGES: Schedule range codes - day or night classes, hours per meeting, meetings per week, duration in weeks; section size range codes - minimum, desired, and maximum section sizes.

2.3 ACTIVITY CHARACTERISTICS-RESOURCE COMBINATION Resource combination codes, and three possible resources, types and categories.

2.4 ACTIVITIES: Activity numbers, names, cost center node of affiliation, specialty and activity type codes, success factors, credit values, schedule and section size range codes, and resource combination codes.

2.5 EXCEPTION ACTIVITIES: Similar to 2.4 except dealing with exception activities. Schedule and section size range codes and resource combination codes are not present. Day or night code, hours per meeting, meetings per week, durations and section sizes (minimum, desired, maximum) are added.

2.6 EXCEPTION ACTIVITY RESOURCES: Exception activities, names, resource requirements (types and categories), cost centers of affiliation, functional codes, quantitites in proportion an day-night codes, hours per meeting, meetings per week and durations for the resource schedule.

3.0 PROGRAMS AND STUDENTS

3.1 PROGRAM CURRICULA AND ACTIVITY PARTICIPATION: Program nodes, names, credit ranges (academic years), credits per credit ranges; program curriculum codes and activity number codes and participation rates that constitute each curriculum.

3.2 INITIAL DISTRIBUTION OF STUDENTS INTO PROGRAMS: For each simulation period there is the total number of new entrants with no academic credit entering all programs, folloed by a breakdown by program node and credit range (academic year) of the number of new students entering without and with academic credit.

3.3 STUDENT TRANSITIONS: For each program node and academic year,

Exhibit 6 (Cont.)

possible destinations (other program nodes and credit ranges) and the transition rates; also a test if enrolment was updated prior to simulation period.

3.4 STUDENT CREDIT LOAD: Student credit loads and percent of students taking each credit load by program node and simulation period.

4.0 STAFF

4.1 ACADEMIC STAFF CHARACTERISTICS: Academic staff ranks, salaries, staffing units, office space, and time profiles for all cost centers ('COMMON'), and for particular cost centers ('EXCEPTIONS').

4.2 ACADEMIC STAFF ACTIVITY DUTIES: Activity type names and staffing units credit per contact hour for all cost centers ('COMMON') and particular ('EXCEPTION') cost centers.

4.3 ACADEMIC STAFF NON-ACTIVITY DUTIES: Non-teaching duties rank codes and names required, staffing units, functional bases and quantities in proportion for all cost centers ('COMMON') and for particular ('EXCEPTION') cost centers.

4.4 ACADEMIC STAFF INVENTORY, TRANSITIONS, AND HIRING CRITERIA: Staff rank codes, names, initial inventory, transitions, hiring criteria and per cent distribution by cost center node.

4.5 ACADEMIC STAFF OPTIMIZATION AND UPDATE POLICIES: General staffing and optimization policies, and transition policy by simulation period and by cost center.

4.6 ACADEMIC SUPPORT STAFF: Support staff codes, names, average salary, contact hours available, and office space.

4.7 NON-ACADEMIC STAFF: Non-academic staff type codes, names, average salaries, office space, functional bases and quantities in proportion by cost center level and node.

5.0 SPACE

5.1 AVAILABLE CLASSROOM SPACE BY COST CENTER: Classroom types available by size (stations) by cost center node.

5.2 AVAILABLE INSTRUCTIONAL LABORATORY SPACE BY COST CENTER: Instructional laboratory types available by size (stations), by cost center nodes.

5.3 AVAILABLE INSTRUCTIONAL SPECIAL LABORATORY SPACE BY COST CENTER: Special laboratory types available by size (stations) by cost center nodes.

5.4 AVAILABLE COST CENTER SPACE BY SPACE CATEGORY: Space category numbers and square feet and stations available, by cost center node.

5.5 ROOM SIZES AND PLANNING FACTORS (SQUARE FEET PER STATION): Station sizes for classrooms and instructional laboratories with the type and number of each. Equipment size codes and number of each size for instructional special laboratories.

5.6 CLASSROOM AND INSTRUCTIONAL LABORATORY CHARACTERISTICS BY TYPE: Classroom and instructional laboratory inventory room type codes, names, maintenance costs, and service characteristic codes.

5.7 INSTRUCTIONAL SPECIAL LABORATORY CHARACTERISTICS BY TYPE: Inventory room type codes, numbers, names, maintenance costs per square foot, service characteristic codes and equipment size codes for instructional special laboratories.

Exhibit 6 (Cont.)

6.0 SPACE
- 6.1 SERVICE SPACE CHARACTERISTICS BY TYPE: Inventory codes, names, type numbers, maintenance cost per square foot and service characteristic codes for service space.
- 6.2 COST CENTER TEACHING WEEKS AND SPACE UTILIZATIONS: Laboratory and classroom teaching hours per week and utilization by cost center level and node.
- 6.3 SERVICE CHARACTERISTIC CODES: Names and codes of service resources.
- 6.4 CONSTRUCTION AND MAINTENANCE COSTS BY SPACE CATEGORY: Inventory space category numbers, codes, names, and costs per square foot for construction and maintenance.
- 6.5 MISCELLANEOUS SPACE INPUT: Classroom manipulation required by type and size. Instructional laboratory manipulation required by type and size (both yes or no). Net/gross space percentage, net to gross construction cost ($/sq. ft.), Office Maintenance cost ($sq. ft.) and office service characteristic codes.
- 6.6 TEACHING SPACE CONTROL CENTERS: Cost center code and name, space control center for classrooms, instructional laboratories and special laboratories.

7.0 SERVICE DEPARTMENTS
- 7.1 SERVICE DEPARTMENTS: Service department codes, names, and cost center nodes of affiliation.
- 7.2 SERVICE STAFF: Service staff codes, names, salaries, space planning factors, functional bases, and quantities in proportion, by service department.
- 7.3 SERVICE SPACE: Service space type codes, names, functional bases and quantities in proportion, by service department.
- 7.4 SERVICE EQUIPMENT: Service equipment codes, names, operating costs per unit, functional bases and quantities in proportion, by service department.

8.0 REVENUE
- 8.1 CHARACTERISTICS OF REVENUE: Revenue types and sources and functional bases; unrestricted or restricted.
- 8.2 REVENUE AT COST CENTERS: Revenue types, names, functional bases, value (restricted or not) by cost center nodes and levels.
- 8.3 REVENUE AT PROGRAMS: Same as 8.2, except by program nodes and levels.
- 8.4 REVENUE AT SERVICE DEPARTMENTS: Same as 8.2 and 8.3, except by service departments.

9.0 MISCELL RESOURCES
- 9.1 EQUIPMENT RESOURCE CHARACTERISTICS: Equipment type codes, names, hours available per week and annual operating costs.
- 9.2 MISCELLANEOUS RESOURCE CHARACTERISTICS: Miscellaneous resource type codes, names, and functional bases.
- 9.3 MISCELLANEOUS RESOURCES BY COST CENTER: Miscellaneous resource type codes, names, and quantities in proportion by cost center nodes and levels.

Exhibit 7

<u>Cost Center Output Reports</u>

Report
<u>No.</u> <u>Title and Contents</u>

1.0 STUDENTS AND ENROLLEES

- **1.1** DIRECT ENROLLEE LOADS BY PROGRAM: A breakdown of student and enrollee loads in programs affiliated to the cost center.
- **1.2** [illegible] AND AGGREGATION OF ENROLLEE LOADS FROM LOWER LEVELS: [illegible] aggregate enrollee loads from directly affiliated cost centers and total accumulated enrollee load at the cost center.

2.0 STAFF

- **2.1** STAFF REPORT ON ACTIVITY CONTACT HOURS PER WEEK: Number and type of contact hours required by activity.
- **2.2** ACADEMIC STAFF INVENTORY BY RANK: Shows the number of staff before and after promotion and the number of staff hired to meet requirements.
- **2.3** DETAILED BREAKDOWN OF DIRECT ACTIVITY AND NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF: Gives type of load, and the number and cost of staff required to meet demand.
- **2.4** ACADEMIC SUPPORT STAFF NON-ACADEMIC SUPPORT STAFF: States number and cost of staff requirements.
- **2.5** SUMMARY STAFF REPORT: Gives staff requirements and costs for affiliated cost centers and aggregate totals at this cost center.

3.0 EQUIPMENT

- **3.1** EQUIPMENT REPORT: Types and cost of equipment required for this cost center.
- **3.2** SUMMARY OF EQUIPMENT OPERATING COSTS: Equipment costs aggregated at this cost center.

4.0 SERVICE

- **4.1** SERVICE DEPARTMENT REPORT: One report for each service department used by the cost center. Gives: number and cost of service staff, space required in square feet and cost, number and operating cost of equipment.
- **4.2** COST CENTER SERVICE DEPARTMENT SUMMARY REPORT: Gives all service departments used by the cost center.

5.0 SPACE

- **5.1** SPACE - NIGHT
  - **5.1.1** CONTACT HOUR SUMMARY FOR NIGHT CLASSROOM ACTIVITIES: This report shows the contact hours required for each size and type of classroom by night activities.
  - **5.1.2** CONTACT HOUR SUMMARY FOR NIGHT INSTRUCTIONAL LABORATORY ACTIVITIES: This report shows the contact hours required for instructional laboratories of each size and type by night activities.

Exhibit 7 (Cont.)

5.1.3 CONTACT HOUR SUMMARY FOR NIGHT INSTRUCTIONAL SPECIAL LABORATORY ACTIVITIES: This report gives the contact hours required by night activities for instructional special laboratories by each size and type of laboratory.

5.2 SPACE - DAY

5.2.1 ACTUAL SPACE REQUIRED FOR DAY CLASSROOM ACTIVITIES: This report shows the actual space required for day classroom activities.

- -The activity number is the internal CAMPUS model code.
- -The sections expected represents the number of sections for that activity based on the enrolment and desired section sizes.
- -It also reports on the type of classroom required, the number of classrooms of that type, and the size of classroom required.
- -The station occupancy represents the percentage of seats occupied in the size of the room chosen when a section of the size indicated is scheduled in that room.
- -The number of hours per week the rooms are required represents the total number of hours per week in that size and type of room for all sections for this particular activity.
- -The number of equivalent square feet represents the theoretical amount of space required by that activity based on the length of the teaching week at the institution and the utilization of rooms experienced with the institution's scheduling system.
- -The actual square feet required by an activity is computed after analyzing all the requirements for a similar type and size of classroom from all other activities. For example, if no other activity required that type and size of classroom, then the physical size of the room in square feet would be charged completely to that activity.
- -The square foot difference is the equivalent square feet subtracted from the actual square feet. Where this difference is very small the activity utilizes space efficiently: i.e. many other activities require a similar size and type of room during the week.

5.2.2 DAY CLASSROOM ACTIVITIES - CONTACT HOUR SUMMARY: This report shows the contact hours required for each type and size of classroom for day time activities requiring classroom space.

5.2.3 DAY CLASSROOM ACTIVITIES - ROOMS REQUIRED: This report is the number of classrooms required of each size and type.

- -The number of classrooms required is computed by dividing the total contact hours by the length of a teaching week in hours and multiplying by the reciprocal of the room utilization of the institution.

5.2.4 DAY CLASSROOM ACTIVITIES - STATION OCCUPANCY: This report shows the average station occupancy that would be experienced by loading the particular section sizes of all day activities requiring classroom space into each size and type of classroom.

5.2.5 DAY CLASSROOM ACTIVITIES - SQUARE FEET REQUIRED: This report indicates the number of square feet of each type and size of classroom required by the cost center.

- -This figure is computed by multiplying the number of rooms required of each type and size times the space planning factor in terms of the number of square feet per station.

Exhibit 7 (Cont.)

5.3 INSTRUCTIONAL LAB SPACE - DAY

5.3.1 ACTUAL SPACE REQUIRED FOR DAY INSTRUCTIONAL LABORATORY ACTIVITIES: This report shows the space requirements for day activities requiring instructional laboratory space.
-The description of each column on the report is the same as that described for the identical report on day classroom activities. The report number is 5.2.

5.3.2 DAY INSTRUCTIONAL LABORATORY ACTIVITIES - CONTACT HOUR SUMMARY: This report gives the number of contact hours required for each type and size of instructional laboratory for day activities requiring this type of space.

5.3.3 DAY INSTRUCTIONAL LABORATORY ACTIVITIES - ROOMS REQUIRED: This report shows the number of instructional laboratories of each type and size required by this cost center for the day activities it supports requiring this type of space.

5.3.4 DAY INSTRUCTIONAL LABORATORY ACTIVITIES - STATION OCCUPANCY: This report shows the average station occupancy in instructional laboratories of each type and size for day time activities that will be scheduled into this particular type of space.
-The average station occupancy is computed by examining the station occupancy for all the individual activities requiring different sizes and types of instructional laboratories.

5.3.5 DAY INSTRUCTIONAL LABORATORY ACTIVITIES - SQUARE FEET REQUIRED: This report indicates the number of square feet required for each type and size of instructional laboratory for the day time activities that this cost center supports.
-The number of square feet required is computed from the number of rooms required multiplied by the number of square feet per station required for each size and type of laboratory.

5.4 SPECIAL LABORATORY SPACE - DAY

5.4.1 ACTUAL SPACE REQUIRED FOR DAY INSTRUCTIONAL SPECIAL LABORATORY ACTIVITIES: This report shows the space requirements for each activity requiring instructional special laboratory space.
-A description of each column on the report can be found on the description of the identical report used for day activities requiring classroom space.

5.4.2 DAY SPECIAL LABORATORY ACTIVITIES - CONTACT HOUR SUMMARY: This report shows the number of contact hours required for each size and type of laboratory for all activities supported by this cost center that require instructional special laboratory space.

5.4.3 DAY SPECIAL LABORATORY ACTIVITIES - ROOMS REQUIRED: This report shows the number of instructional special laboratories required of each type and size.
-The number of rooms required is computed by dividing the number of contact hours for each size and type of laboratory by the length of the teaching week in hours and multiplying by the reciprocal of the room utilization experienced through the institution's scheduling system.

Exhibit 7 (Cont.)

5.4.4 DAY SPECIAL LABORATORY ACTIVITIES -STATION OCCUPANCY: This report shows the average station occupancy expected for each type and size of special laboratory.

5.4.5 DAY SPECIAL LABORATORY ACTIVITIES - SQUARE FEET REQUIRED: This report shows the number of square feet required for each type and size of instructional special laboratory.
-The total number of square feet of instructional special laboratory space required by a cost center is computed by adding all the elements of this matrix.

5.5 OFFICE SPACE REQUIREMENTS: This report indicates the number of square feet of office space required by a cost center broken out by each type of rank of staff.
-A subtotal is given for academic staff, academic support staff, non-academic staff, and service department staff. These four subtotals are added to get the total office space requirements for the cost center.
-On the lower part of the report the office space requirements for directly affiliated cost centers at all levels are shown and added in to get the aggregate office space requirements for this cost center.

6.0 SPACE

6.1 COST CENTER SPACE REQUIREMENTS

6.1.1 COST CENTER SPACE REQUIREMENTS: This report shows the square foot requirements for classroom, instructional laboratory, instructional special laboratory, office, and service space.
-The maintenance cost for each category of space is also reported in dollars.
-The total space requirements and maintenance budget for the cost-center are shown.

6.1.2 COST CENTER SPACE REQUIREMENTS AND MAINTENANCE COST SUMMARY: This report shows the space requirements and maintenance cost for the particular cost center being considered, and for directly affiliated cost centers.
-The aggregate requirements for cost centers up to and including this particular cost center are shown.
-The total maintenance cost and the subtotal for each affiliated cost center are rounded to the nearest thousand dollars.

6.2 COST CENTER SPACE REQUIREMENTS

6.2.1 COST CENTER SPACE REQUIREMENTS BY SERVICE CODE

6.2.2 TOTAL SPACE REQUIREMENTS BY SERVICE CODE FOR ALL COST CENTERS: This report shows the total space required by a cost center broken out by various services or utilities that would have to be provided for the space.
-This information is assembled by examining the total characteristic codes attached to each type of space.
-We can thus see the number of square feet and the percentage of the total square feet required that must be air-conditioned, carpeted, have a heavy duty floor, etc.

Exhibit 7 (Cont.)

6.3 REQUIRED VERSUS AVAILABLE SPACE BY SPACE CATEGORY: This report groups the total space requirements of a cost center into various space categories and matches the required space to that available to that cost center.
- The maintenance cost is also given for each space category in dollars.
- A square foot shortage or surplus is computed and printed when the required space is compared to the available space.

6.4 SPACE MATCHING

6.4.1 SPACE MATCHING REPORT FOR CLASSROOMS AND INSTRUCTIONAL LABORATORIES: This report indicates the results of matching requirements for classrooms and instructional laboratories to the number of rooms available.
- The shortage or surplus of rooms for each type and size of classroom and instructional laboratory is printed.
- Information is given on a report which indicates if a classroom or laboratory manipulation is performed across type or size of room. For example, a shortage of a small size room could be fulfilled by an extra room of some larger size. There would be a marked drop in station occupancy, but this may be tolerated instead of building an extra small size room. However, currently these manipulations are not programmed in the model.

6.4.2 SPACE MATCHING REPORT FOR INSTRUCTIONAL SPECIAL LABORATORIES: This report shows the results of matching requirements for instructional special laboratories to the available laboratories.
- The shortage or surplus of special laboratories for each size and type of laboratory is given.
- Because of the highly specialized nature of instructional special laboratories, no manipulation by size or type is performed.

6.5 SPACE CAPITAL COST REPORT: This report indicates the capital required to construct any shortage of space.
- The space shortage in square feet is multiplied by a dollar per square foot construction cost to give the capital required.
- The space shortage by space category is an accumulative array. The space shortages are accumulated over time if no construction takes place during the particular session. The message at the bottom of the report indicates that that policy has been simulated.
- The net to gross space is an added amount of space reflecting wall thickness, etc.

7.0 SUMMARY

7.1 DIRECT LOAD GENERATED BY ACTIVITIES (CONTACT HOURS): Resource requirements of each activity in contact hours.

7.2 DIRECT LOAD GENERATED BY ACTIVITIES - SUMMARY (DOLLARS AND SQ. FT.)

7.3 DIRECT LOAD GENERATED BY ACTIVITIES

7.3.1 DAY CLASSROOM ACTIVITIES SPACE REPORT

7.3.2 NIGHT CLASSROOM ACTIVITIES SPACE REPORT

7.3.3 DAY INSTRUCTIONAL LABORATORY ACTIVITIES SPACE REPORT

Exhibit 7 (Cont.)

7.3.4 NIGHT INSTRUCTIONAL LABORATORY ACTIVITIES SPACE REPORT
7.3.5 DAY SPECIAL LABORATORY ACTIVITIES SPACE REPORT
7.3.6 NIGHT SPECIAL LABORATORY ACTIVITIES SPACE REPORT: This report is produced for day and night classroom, instructional laboratory, and instructional special laboratory activities.
- The report is produced as each cost center is processed and shows the number of equivalent square feet required for each activity supported by that cost center.
- The activity number is the internal CAMPUS model code.
- The enrolment is the number of students taking that course.
- The desired section size is the number of students desired in each section of that activity.
- The section sizes show the actual number of students in each section of the activity.
- The number of the particular type and size of classroom required is shown.
- The station occupancy represents the percentage of stations in the classroom that would be filled by the particular section size.
- The hours per week that the rooms are required is the total hours for all sections.
- The total square feet represents the number of square feet required by this activity based on the current room utilization and the length of the teaching week.

7.4 SUMMARY OPERATING REPORT (FOR THIS COST CENTER ONLY): Summary of student loads, space requirements and operating costs for this cost center.

7.5 SUMMARY OPERATING REPORT (AGGREGATE REPORT): as 7.4 with totals including all affiliated cost centers.

Exhibit 8

Overtime Reports

1.1 STUDENT AND ENROLLEE LOAD: Included in it are the arrays summed over each period and averaged for the period, for a maximum of ten periods. They are written out with values for the particular cost center, the cost centers affiliated to it, if any, and totals where necessary.

1.2 STAFF COSTS: It indicates staff costs, a breakdown of academic staff number and aggregate staff cost. Each of these sections are broken down even further. Totals and subtotals are also included. This report is written for each cost center requiring it.

1.3 SPACE REQUIREMENTS: Data is broken down into the space categories of office, classroom, instructional laboratory, special laboratory and service department with a total. This report is written out for any cost center requiring it.

1.4 OPERATING COSTS: Included in this report are staff, equipment, maintenance, miscellaneous, space and service costs. The actual numbers are printed out with total staff cost, total equipment cost as subtotals, and total operating cost as the grand total. In the same report, there is a section for total aggregate cost.

1.5 SUMMARY REPORT: This section summarizes data in report 1.1 to report 1.4 inclusive. It illustrates staff costs in some detail. However only totals are given for equipment, miscellaneous, and maintenance costs. The total aggregate cost is also included. The space (in square feet) is shown in some detail: that is, shown by space type category. The affiliated students are also shown in this report as they appeared in report 1.1. The revenue is written for each cost center requiring it. A section of indicators occurs at the end of this report, including such items as 'cost per student ($)', 'space per student (sq. ft.)' etc.

Exhibit 9

Project PRIME Reports

Project PRIME Report No.	Description	Author
1.	Test Implementation of CAMPUS (A Computer Based Simulation Model) for Higher Education Administration and Planning in Minnesota, March 1970.	Andrew, Cordes, Lorents
2.	An Introduction to Project PRIME and CAMPUS-MINNESOTA, November 17, 1970.	Cordes
3.	Planning, Programming, and Budgeting Systems in Higher Education: An Annotated Bibliography (in progress).	Cordes
4.	Planning, Programming, and Budgeting Systems in Education: Concept, Operation, Status, and a School of Business Administration Example, May 1970 (Also available from Management Information Systems Research Center as Research Monograph No. 1).	Cordes
5.	Program Costing with CAMPUS-MINNESOTA: A Philosophic Note, (in progress).	Cordes
6.	Analysis of Faculty Activities for Resource Allocation Models, (in progress).	Lorents
7.	A Faculty Activity Information Subsystem and CAMPUS-MINNESOTA, (in progress).	Lorents
8.	Program Accounting with CAMPUS-MINNESOTA, (in progress).	Davitt
9.	A Curriculum Cost-Benefit Analysis, (in progress).	Fisher
10.	Resource Analysis Models in Higher Education: A Synthesis (in progress).	Cordes
11.	Converting CAMPUS V to CAMPUS-MINNESOTA (in progress).	Davitt
12.	INPUT COMMAND: Draft Documentation November 1970.	Cordes
13.	Applying Input/Output Analysis and the EL FYD Model to Higher Education (in progress).	Cordes
14.	Mid-Year Progress Report, January 1971.	Andrew, Cordes, Lorents

Revised 1/21/71

Exhibit 10

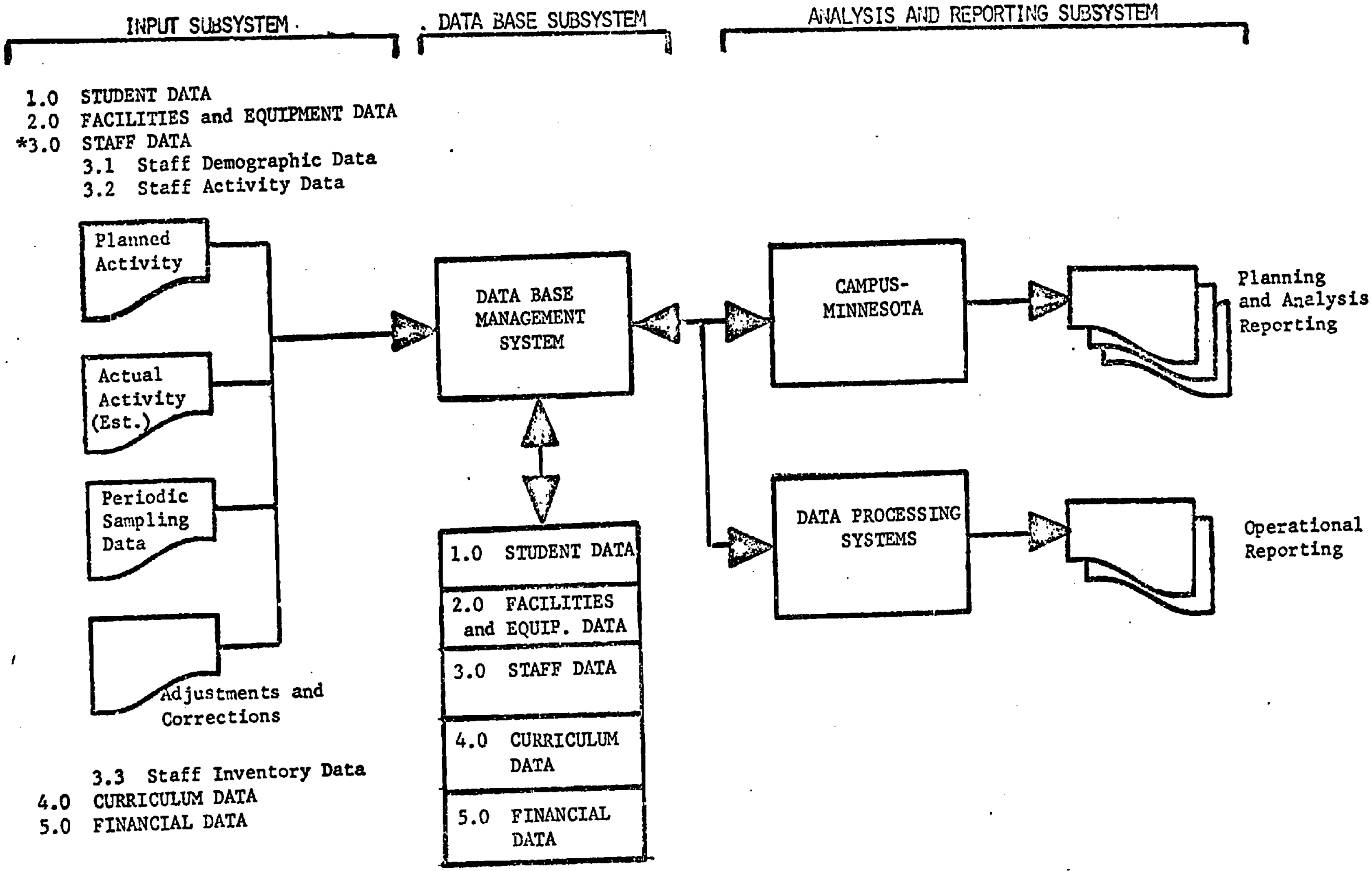
Resource Information for A Typical Program Element[1/]

	School Year				
	68/69	69/70	70/71	71/72	72/73
OPERATING COST					
Staff					
Academic (Professors, Assciate, Etc.)					
Academic Support (Teaching Assistants, Etc.)					
Non-Academic Support (Secretaries, Tutors)					
Service (Civil Service Personnel)					
Equipment Cost $					
Instructional Labs					
Special Labs					
Service Department					
Maintenance					
Office					
Classroom					
Instructional Labs					
Special Labs					
Service Department					
Miscellaneous					
Benefits					
Travel					
Conferences					
Supplies					
Telephone					
Recruitment					
Computer Cost					
Total Operating Cost					
INVESTMENT COST					
Equipment					
Construction					
SPACE					
Classroom (By Type, Size, and Stations)					
Instructional Labs (By Type, Size, and Stations)					
Special Labs (By Type, Size and Stations)					
Office (By Size)					
Service Department (By Type and Size)					
EQUIPMENT REQUIRED (No. by Type)					
STAFF REQUIRED					
Academic (By Rank)					
Academic Support (By Rank)					
Non-Academic Support (By Rank)					
Service Department (By Type)					

[1/] Additional "backup" information would be avilable for all resource categories. Categories primarily based on those available from CAMPUS Simulation Model.

Exhibit II

CAMPUS-MINNESOTA AND A UNIVERSITY INFORMATION SYSTEM



*Staff data has been shown in more detail as an example

ACL
11-17-70

Exhibit 12

Project PRIME Staff

DIRECTOR:	Gary M. Andrew
ASSOCIATE DIRECTORS:	David C. Cordes Alden C. Lorents
PROGRAM ANALYSTS:	Patrick Davitt Milton S. Fisher Edward Hwang Raymond Pinson Charles Rogers (Left Project)
PROJECT CONSULTANTS:	William Harman David Sommer
SECRETARY:	Mary Wenker

APPENDIX B

SELF SAMPLING DEVICES

RANDOM SIGNAL GENERATOR

Self contained device with batteries.

Size: 4 1/2" x 2 1/2" x 1 1/4"

Weight: 10 oz.

Mean time adjustable between 2 and 30 minutes. Delivers a steady "beep" until the reset button is pushed. This is a reliable and well built device, but it is too heavy for shirt pocket use. It also uses about $3.00 worth of batteries per week. Purchase price is $235.00.

Distributer:
Meylan Stopwatch Corp.
264 West 40th Street
New York, New York 10018

RAM-1

Self contained device with batteries.

Size: 2" x 21/2" x 3/4"

Weight: 3 oz. plus 1 oz. speaker.

Mean time adjustable to interval desired. Delivers a ten second beep and automatically shuts off. The device is small enough to carry in one's pocket. The battery lasts for 1.5 years. Purchase price is $60.00.

Distributer:
Electronic Ideas, Inc.
Reading R.R. Terminal
Wyncote, Pennsylvania 19095

MEMO TIMER

Small key chain device that is mechanical. This device can be set for any time up to 120 minutes.

Distributer:
Endura Time Corporation
L. Harris Company
450 West 33rd Street
New York, New York 10001

PAGEMASTER SYSTEM

The pagemaster units come in tone only or tone and voice. Generally, these systems operate through a leasing arrangement with companies like "Pageboy". The units rent for $24.00 per month which includes unlimited calls 24 hours per day. The units sell for $325. A complete system of twenty units with a base station would cost about $8500. A license is required to operate the station.

Suppliers of these systems include:

1. Motorola Communications and Electronics
   4501 Augusta Blvd.
   Chicago, Illinois 60651

2. E. F. Johnson and Company
   Waseca, Minnesota

APPENDIX C

FORMS USED IN THE STUDY

FACULTY ACTIVITY ANALYSIS

ACTIVITY SELF SAMPLING PARTICIPATION QUESTIONNAIRE

All faculty (including T.A.'s and R.A.'s) will be asked at the end of Winter Quarter to estimate the time they spent during the quarter by category of activity. (Total hours for the Quarter in each category.)

In addition, selected members of full time faculty will be asked to cooperate in an activity self-sampling study. The sampling will be 8 to 10 observations per day, triggered by a small random alarm device that can be conveniently carried. The faculty member will be asked to make a hash mark on a card corresponding to the activity that he was engaged in at the time of the alarm.

In return the faculty member will receive (1) a summary of how he distributed his time and (2) a summary of how the aggregate faculty distributed their time across the various activities.

There will be no individual identification of data except to track down missing data and to get individual data back to the faculty member. The cross reference of number to name will be available only to one project member and a clerical assistant.

The following information is needed now in order to complete the statistical design of the data collection.

Name______________________________

I would be willing to sample my activity over a period of:

☐ 12 weeks

☐ 6 weeks

☐ 3 weeks

I do not wish to sample my activity.

☐

PROJECT PRIME
FACULTY ACTIVITY ANALYSIS
DATA COLLECTION
General Instructions

1. Estimate the TOTAL HOURS you spent in each category for the period indicated. (Do not use fractions) There are 12 weeks in the period so the total hours for all activities should be in the range of 300 to 800 hours. When a significant amount of time has been spe   specific activity, please list this activity and the estimated hours separetely. Reference filled out sample f

SAMPLE COPY

2. Teaching assistants should fill in only

3. The entire set of instructions and examples sho   eding to fill out your form.

4. Please list specific activities under the appropriate catego..   the specific activities should have already been listed where they were previously known. Please make addi.   .eletions, or corrections.

5. Please complete the form within 2 days and return it to your departmental secretaries. Do not put your name on it. There will be no individual identification of data.

6. If there are any questions please call Alden Lorents 221-6872.

PROJECT PRIME

FACULTY ACTIVITY ANALYSIS
DATA COLLECTION FORM

NUMBER 42 PERIOD JAN 4 - March 28

FILL IN APPROPRIATE CELLS WITH THE TOTAL HOURS FOR THE PERIOD.

1.1 INSTRUCTION – COURSE RELATED

Course Number– Course number as listed in the bulletin.

Number of Students– Number of Students in the Class

Level–Ignore

Ext.– Put an "E" in the cell if the course is an extension course. (Part I, EMBA is Ext., Part II is not)

Times Taught Previously– Indicate the number of times you have previously taught the course.

Classroom Contact– All hours spent in the classroom during scheduled hours. Additional regularly scheduled labs, help sessions, etc. are to be included. A 45 minute period is considered an hour.

Evaluation– All hours spent on the course in grading papers, exams, and determining grades. In general it is all evaluation work that is variable with the number of students.

Other Contact– Contact hours spent with students related to the course outside of scheduled class or lab times. (Student program advising and other non-instruction related activities should be recorded in "Student Support Services", section 6.0)

Preparation– Number of hours spent in preparing course materials, lectures, readings, tests, etc. In general this covers all activities related to the course outside the classroom that are nonvariable with the number of students. This also includes preparation for courses to be taught in future quarters, as well as minor curriculum development. It also includes all other miscellaneous activity pertaining to the course that can't be classified in the above categories.

Totals– Total hours across for each line.

COURSE NUMBER	NO. OF STUDENTS	LEVEL	EXT	TIMES TAUGHT PREV	CLASS CONTACT	EVAL-UATION	OTHER CONTACT	PREP-ARATION	TOTAL
8-209	42			2	25	15	10	25	75
8-239	28		E	8	23	5	12	40	80
8-229				0				20	20
				SAMPLE					
								TOTAL	175

1.2 INSTRUCTION — STUDENT RELATED RESEARCH AND OTHER INSTRUCTION

This category includes all time spent on dissertation and thesis activity, Plan A and Plan B papers, and Ph. D. and Masters exams. It also includes all other consulting with students on subject matters other than consulting related to a course presently being taught by you. (Part I EMBA is Extension. Part II is not)

	EXTENSION TOTAL	REGULAR TOTAL
UNDERGRADUATE		10
MASTERS	20	30
PH.D.		
TOTAL	20	40

SAMPLE

2.0 RESEARCH AND SCHOLARLY ACTIVITY

This category includes all research, creative and scholarly activity done primarily with no students. Included are writing (published or unpublished), research projects (proposal work, research work, results dissemenation), and works of art. Separate University funded and departmental activity (DEPARTMENT) from externally funded projects (SPONSORED). All activity in this categorv not specifically funded is to be classified as department research. NOTE: All miscellaneous activity (such as clerical activity, reading mail, and transit time) pertaining directly to activities in this category should be included as a part of the activity.

	SPONSORED	DEPARTMENT
Investigation of COBOL ERRORS		28
SIMULATION MODEL FOR HIGHER Ed	40	
Book "INTRODUCTION TO MIS"		30
TOTAL	40	58

SAMPLE

3.0 PUBLIC RELATIONS AND SERVICE

This category includes all activities related to consulting, speaking engagements, recruiting students, and offices in professional organizations. Do not include civic, private and church organizations unless you are specifically representing the college or university. Put paid and unpaid consulting on separate lines. Unpaid includes consulting done for a nominal fee. NOTE: All miscellaneous activity (such as clerical activity, reading mail, and transit time) pertaining directly to activities in this category should be included as a part of the activity.

	PAID	UNPAID
CONSULTING	30	20
PRES LOCAL CHAPT DPMA		16
DELIVERED A PAPER AT DPMA		30
SAMPLE		
TOTAL	30	66

4.0 DEPARTMENTAL SERVICES

This category includes all administrative duties related to departmental services. Included are department meetings, department committee assignments, major curriculum development, recruiting faculty, and all correspondence, reading, phone conversations, and clerical work regarding departmental activities.

	EXTENSION TOTAL	REGULAR TOTAL
DEPT CHAIRMAN		76
FACULTY MEETINGS		10
SUPERVISE EXT PROGRAM	20	
SUPERVISE RESEARCH CENTER		18
SAMPLE		
TOTAL	20	104

5.0 STUDENT SUPPORT SERVICES

This category includes all services related to advising student programs and activities, directing student performances, and all other services for the student such as letters of recommendation, etc. NOTE: All miscellaneous activity (such as clerical activity, reading mail, and transit time) pertaining directly to activities in this category should be included as a part of the activity.

	EXTENSION TOTAL	REGULAR TOTAL
ADVISING STUDENT PROGRAMS	5	10
ADVISING BETA ALPHA PSI		15
ATTENDING STUDENT ORGANIZATION MEETING		5
GENERAL STUDENT DISCUSSIONS		12
SAMPLE		
TOTAL	5	42

6.0 INSTITUTIONAL SERVICES

This category includes all services provided for administrative activities beyond the department level. Included are committee work, meetings, and all correspondence, reading, phone conversations, and clerical work related to School of Business Administration or University activities.

	UNIVERSITY TOTAL	SBA TOTAL
LONG RANGE PLANNING COMMITTEE - SBA		20
PARKING COMMITTEE - U of M	10	
FACULTY MEETINGS - SBA		3
DIRECTOR COMPUTER CENTER - SBA		15
SAMPLE		
TOTAL	10	38

7.0 PROFESSIONAL DEVELOPMENT

This category includes all activities related to professional reading (nonspecific to a present course), seminars, workshops, conferences, conventions (Offices held are classified under Public Service), taking courses, and attending faculty discussions and seminars. NOTE: All miscellaneous activity (such as clerical activity, reading mail, and transit time) pertaining directly to activities in this category should be included as a part of the activity.

	TOTAL
ATTEND AEDS CONFERENCE	20
GENERAL READING AND DISCUSSIONS	18
SAMPLE	
TOTAL	38

FINAL TOTAL HOURS 686

FACULTY ACTIVITY SAMPLING

INSTRUCTION BOOKLET

December, 1970

Project PRIME

FACULTY ACTIVITY SAMPLING INSTRUCTIONS

1. Remember to keep the RAM-I with you.
2. Start each day on a separate card. Fill in your NUMBER, the DATE, and the TIME STARTED. When you decide to stop sampling, fill in the TIME STOPPED. CARD NUMBER should be used to number the cards if there are multiple cards for the day.

   MAKE SURE THAT THE INTERVAL REPRESENTED BY THE START AND STOP TIMES DOES NOT INCLUDE TIME WHICH IS LOGGED, OR TIME WHEN THE DEVICE IS NOT CARRIED.
3. For each alarm record the time of the alarm in the first open box on the back of the card. Then record the number of that box in the category on the front of the card corresponding to the activity engaged in at the time of the alarm. If you wish, you may record a note pertaining to this activity in the same box that you recorded the time.
4. Turn the wheel on top of the device at least 1/4 turn after or during each alarm. The wheel randomly sets the length of the next interval. If you forget to turn the wheel, the next interval will be approximately the same length as the previous interval. The alarm sounds for 10 seconds and automatically shuts off.
5. When you log time fill in the top of a new card including start and stop times. (Start and stop times are not required when logging weekend activity) Then record the time in the appropriate categories. Time should be recorded in hours and minutes. (1 hour and 15 minutes equals 1:15) The back of the card is not used when you are logging hours.

   MAKE SURE THAT THE TIME YOU ARE LOGGING IS NOT PART OF ANY SAMPLE INTERVAL.
6. When you stop sampling and you wish to shut off the alarm, pull the speaker plug. MAKE SURE YOU REPLACE IT WHEN YOU START SAMPLING AGAIN.
7. There will be a box in each department office for collecting the cards. Please deposit them weekly so that they do not get lost.
8. If you forget to record for a day or a device fails, estimate and log the number of hours spent in each of the categories for that day. Do not estimate personal time (other).
9. The interval between alarms has an exponential distribution with a mean of approximately 60 to 90 minutes. Consequently, an interval can be 5 minutes or it can be 360 minutes or anything in between.
10. There will be no need to replace batteries during the study. Please do not break the seal and open the device. If you wish to examine the alarm, there is a disassembled model in the Dean's office.
11. No alarms during a period of six hours or more is the only way you can tell that the device is not operating properly. If this problem occurs (or if you have any other problems or questions related to the project) please contact:

    Alden Lorents
    221-6872 Project Office
    373-5591 University
    646-8416 Home

    Gary Andrew
    221-6872 Project Office
    373-4591 University
    560-7848 Home
12. Saturday and Sunday activity should be logged or sampled for each of the weekends following the week that you were sampling. You may sample if you wish, or it may be more convenient to log the hours spent in each category for each day. Put Saturday and Sunday on separate cards.
13. MAKE SURE THAT ALL FACULTY ACTIVITY IS COVERED EITHER BY LOGGING OR BY SAMPLING.

FACULTY ACTIVITY DATA CARD CATEGORY DEFINITIONS

The following paragraphs describe the types of activities that correspond to each category. The descriptions are not exhaustive, but are representative examples. This will guide you in the classification of the activity you were engaged in at the time of the alarm.

1.1 INSTRUCTION – COURSE RELATED

Classroom Contact- All time spent in the classroom during scheduled hours. Additional regularly scheduled labs, help sessions, etc. are to be included.

Evaluation- Time spent on the course in grading papers, exams, and determining grades. In general it is all evaluation work that is variable with the number of students.

Other Contact- Contact time spent with students related to the course outside of scheduled class or lab times. (Student program advising and other non-instruction related activities should be recorded in "Student Support Services", section 6.0)

Preparation- All time spent in preparing course materials, lectures, readings, tests, etc. In general this covers all activities related to the course outside the classroom that are nonvariable with the number of students. This also includes preparation for courses to be taught in future quarters, as well as minor curriculum development. It also includes all other miscellaneous activity pertaining to the course that can't be classified in the above categories.

(Part I EMBA is Extension, Part II is not.)

(3-XXX, 5-XXX, 8-XXX refer to 3, 5, and 8 level courses.)

1.2 INSTRUCTION – STUDENT RELATED RESEARCH AND OTHER INSTRUCTION

This category includes all time spent on dissertation and thesis activity, Plan A and Plan B papers, and Ph. D. and Masters exams. It also includes all other consulting with students on subject matters other than consulting related to a course presently being taught by you. (3-XXX equals Undergrad level students. 5-XXX equals Masters level students, 8-XXX equals Ph.D. level students.)

2.0 RESEARCH AND SCHOLARLY ACTIVITY

This category includes all research, creative and scholarly activity done primarily with no students. Included are writing (published or unpublished), research projects (proposal work, research work, results dissemination), and works of art. Separate University funded and departmental activity (DEPARTMENT) from externally funded projects (SPONSORED). All activity in this category not specifically funded is to be classified as department research. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

3.0 PUBLIC RELATIONS AND SERVICE

This category includes all activities related to consulting, speaking engagements, recruiting students, and offices in professional organizations. Do not include civic, private and church organizations unless you are specifically representing the college or university. Put paid and unpaid consulting on separate lines. Unpaid includes consulting done for a nominal fee. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

4.0 DEPARTMENTAL SERVICES

This category includes all administrative duties related to departmental services. Included are department meetings, department committee assignments, major curriculum development, recruiting faculty, and all correspondence, reading, phone conversations, and clerical work regarding departmental activities.

5.0 STUDENT SUPPORT SERVICES

This category includes all services related to advising student programs and activities, directing student performances, and all other services for the student such as letters of recommendation, etc. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

6.0 INSTITUTIONAL SERVICES

This category includes all services provided for administrative activities beyond the department level. Included are committee work, meetings, and all correspondence, reading, phone conversations, and clerical work related to School of Business Administration or University activities.

7.0 PROFESSIONAL DEVELOPMENT

This category includes all activities related to professional reading (nonspecific to a present course), seminars, workshops, conferences, conventions (Offices held are classified under Public Service), taking courses, and attending faculty discussions and seminars. NOTE: All miscellaneous activity pertaining directly to activities in this category (such as clerical activity, reading mail, and transit time) should be included as a part of the activity.

8.0 PERSONAL TIME (WORK)

This includes time that should be charged to the other categories proportional to the amount of time spent in those activities. This would include all personal activity intermixed with regular faculty activities. Normally it's an interruption of short duration (1/2 hour or less) such as a personal phone call, personal break (coffee, etc.), or other activity that can't be assigned to any one specific activity.

9.0 PERSONAL TIME (OTHER)

This refers to all personal time while not at work. Normally, time spent with the family, personal errands, and all other activities non-related to the activities above will be a part of this activity.

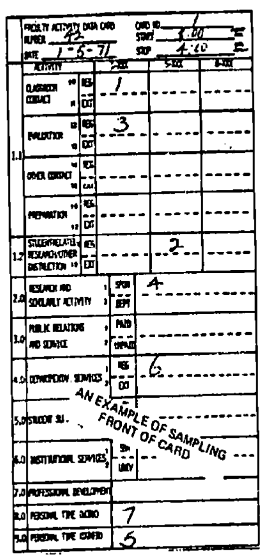
ALTERNATIVES FOR RECORDING A DAYS ACTIVITY

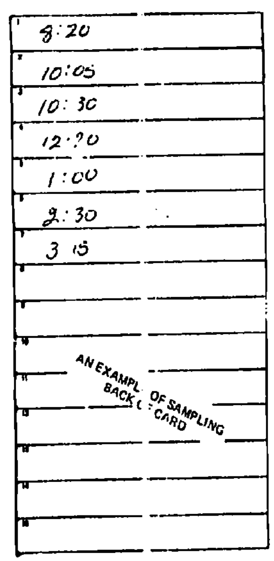
The following chart shows some examples of recording a days activity. All gaps will be considered personal time. The start and stop times must be recorded for each segment sampled or logged. Each segment is recorded on a separate card. The day can be divided into any number of segments, however, one to three segments should generally be sufficient.

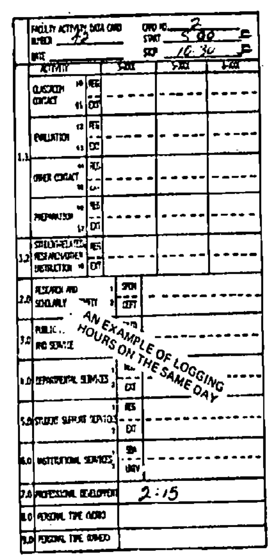
EXAMPLE ONE is an example of sampling the entire day. EXAMPLE TWO is a situation where two different parts of the day are sampled separated by a gap of personal time. The personal time could be a period between the day and evening activity. EXAMPLE THREE is the same as example two except the second segment is logged. This is convenient when the segment pertains primarily to one category, or the subject forgets to turn on the device. EXAMPLE FOUR shows a situation where part of the day is logged and part is sampled with no gap between the segments. EXAMPLE FIVE is an illustration of logging the entire day. This is convenient: (a) when a device fails, (b) to record weekend activity, (c) to record when the entire day is primarily one category, or the activity is such that it is not convenient to sample it.

1.	GAP	SAMPLE SEGMENT CARD 1		
2.	GAP	SAMPLE SEGMENT CARD 1	GAP	SAMPLE SEGMENT CARD 2
3.	GAP	SAMPLE SEGMENT CARD 1	GAP	LOGGED SEGMENT CARD 2
4.	GAP	SAMPLE SEGMENT CARD 1		LOGGED SEGMENT CARD 2
5.	GAP	LOGGED SEGMENT CARD 1		

24 HOURS







PROJECT PRIME

FACULTY ACTIVITY STUDY

POST EVALUATION QUESTIONNAIRE

SECTION I

1.0 Categorize the following activities as you would have if you had encountered them while you were SAMPLING. Place the category number beside the activity. The categories and their numbers are listed below.

_______ 1.1 Discussing with a Ph.D. student the pros and cons of accepting a teaching position at "X" institution.

_______ 1.2 Assisting a student with a term paper he is writing for a course you are presently teaching.

_______ 1.3 Discussing with a student his registration for next quarter.

_______ 1.4 Preparing questions for a Ph.D. oral exam.

_______ 1.5 Riding on the elevator on your way to an SBA faculty meeting.

1.6 Talking in the hallway to another professor:

_______ 1. About yesterday's hockey game.

_______ 2. About the St. Paul move.

_______ 3. About problems with a particular course you are teaching.

_______ 4. About a current research project you are engaged in.

_______ 1.7 Grading papers for a current course.

_______ 1.8 Talking to a student from the College of Education on a term paper he has in an education course.

_______ 1.9 On a trip to interview for a position at another University.

_______ 1.10 Writing a text book.

_______ 1.11 Traveling to Chicago to give a talk at the AMA convention.

_______ 1.12 Attending the DPMA convention in Toronto.

_______ 1.13 Having lunch with a prospective candidate for a position at the Business School.

_______ 1.14 Advising a student on a Ph.D. dissertation topic.

_______ 1.15 Directing a funded research project.

_______ 1.16 Traveling to school from home for class in the morning.

_______ 1.17 Traveling to San Fransisco on a consulting assignment.

10 Classroom Contact
12 Evaluation
14 Other Contact
16 Preparation
18 Student Related Research/ Other Instruction
20 Research and Scholarly Activity
30 Public Relations and Service
40 Departmental Services
50 Student Support Services
60 Institutional Services
70 Professional Development
80 Personal Time (Work)
90 Personal Time (Other)

2.0 What problems did you have using the random signaler device. Place an X in the appropriate box for each item. List additional items as necessary.

No Problems	Some Problems	Extreme Problems	
1	2	3	2.1 Bulky to carry.
1	2	3	2.2 Hard to hear.
1	2	3	2.3 Disturbing to you.
1	2	3	2.4 Forget to carry it.
1	2	3	2.5 Time consuming.
1	2	3	2.6 Disturbing to others.
1	2	3	2.7 Device reliability.
1	2	3	2.8 ______________ Other (List)
1	2	3	2.9 ______________
1	2	3	2.10 ______________

3.0 Which categories gave you the most difficulty to understand and use.

No Problems	Some Problems	Extreme Problems	
1	2	3	3.1 Classroom Contact
1	2	3	3.2 Evaluation
1	2	3	3.3 Other Contact
1	2	3	3.4 Preparation
1	2	3	3.5 Student Related Research/Other Instruction
1	2	3	3.6 Research and Scholarly Activity
1	2	3	3.7 Public Relations and Service

No Problems	Some Problems	Extreme Problems	
1	2	3	3.8 Departmental Services
1	2	3	3.9 Student Support Services
1	2	3	3.10 Institutional Services
1	2	3	3.11 Professional Development
1	2	3	3.12 Personal Time (Work)
1	2	3	3.13 Personal Time (Other)

4.0 Please make any other comments concerning problems you had that would be helpful to consider in future studies.

SECTION II

For all questions in this section assume that a system were set up to record the time spent by faculty members on different activities. The system will be used by department heads and by individual faculty members to assist the planning process regarding activity allocation and loading.

1.0 Indicate on the scale with an X your REACTION toward using each of the following methods to collect input for the system. ASSUME THAT DATA IS COLLECTED BY THIS METHOD EACH QUARTER FROM EVERY FACULTY MEMBER.

Strong Dislike		Indifferent		Strong Preference	
1	2	3	4	5	1.1 Daily estimates
1	2	3	4	5	1.2 Weekly estimates
1	2	3	4	5	1.3 Quarterly estimates
1	2	3	4	5	1.4 Combination of sampling (using random beepers*) and estimating (logging).

2.0 Same as 1.0 above except: ASSUME THAT INPUT BY THIS METHOD IS COLLECTED ONE QUARTER OUT OF EVERY SIX ON RANDOM QUARTERS.

Strong Dislike		Indifferent		Strong Preference	
1	2	3	4	5	2.1 Daily estimates
1	2	3	4	5	2.2 Weekly estimates
1	2	3	4	5	2.3 Quarterly estimates
1	2	3	4	5	2.4 Combination of sampling (using random beepers*) and estimating (logging).

3.0 Indicate on the scale with an X your opinion regarding the usefulness of this data for each of the following items.

Useless		Useful		Very Useful	
1	2	3	4	5	3.1 Departmental planning and allocation of faculty effort.
1	2	3	4	5	3.2 Planning by the individual faculty member of his own time.

*Assume that the beeper is the size of a wrist watch, and that it can be worn like one.

4.0 How much time PER QUARTER do you feel would be WORTH spending PER FACULTY MEMBER in accounting for how he distributes his time. Place an X in front of your choice.

______ 4.1 Zero Hours	______ 4.4 3 - 6 Hours
______ 4.2 0 - 1 Hours	______ 4.5 6 - 12 Hours
______ 4.3 1 - 3 Hours	______ 4.6 More than 12 Hours

5.0 Assume you were to carry the device 1 quarter out of every six. What would be a reasonable length of time to carry the device during the quarter.

______ 5.1 Zero Weeks	______ 5.5 7 - 8 Weeks
______ 5.2 1 - 2 Weeks	______ 5.6 9 - 10 Weeks
______ 5.3 3 - 4 Weeks	______ 5.7 10 - 12 Weeks
______ 5.4 5 - 6 Weeks	

6.0 Which would you prefer?

______ Sample 10 points per day over 20 days.

______ Sample 5 points per day over 40 days.

7.0 What seems to be an optimum number of sample points per eight hour period?

______ 2	______ 10
______ 4	______ 12
______ 6	______ 14
______ 8	______ 16

APPENDIX D

GENERATING FACULTY INPUTS FROM A FACULTY INFORMATION SYSTEM

GENERAL DESCRIPTION

A university information system should be designed to serve both the transaction processing needs and the information needs of management. The chart in Figure D-1 on the following page illustrates the general flow of a system to serving both the transaction data systems and the planning systems.

The input of faculty data has been emphasized in this chart to coincide with the emphasis in this paper. A program could be developed to interface the data base that is routinely maintained by the transaction processing system with the CAMPUS planning model. The following sections describe a sample data base and how it could be used to generate the staff input parameters to CAMPUS

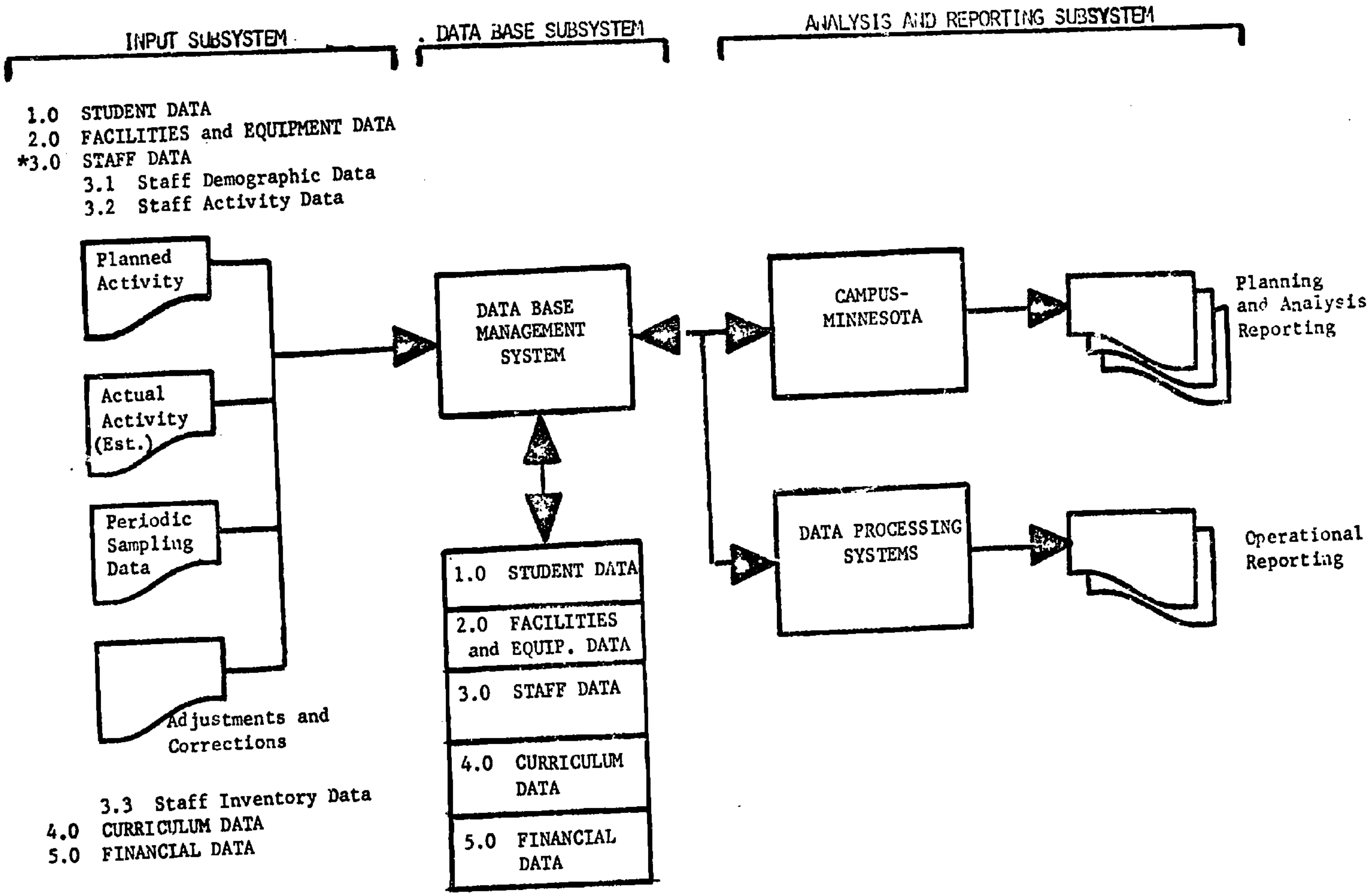
FILE PROCESSING

All files have been structured for direct access processing. History files can be stored on tape and read to disk when needed for processing. The structure of the files will depend on the hardward configuration available.

The instructor and activity files have been set up with direct addressing. This means the instructor number is the same as the address where it is stored on disk or some multiple of it. The same is true of the activity file. All the history files are trailer files to the activity and instructor files. They are stored in sequence by activity number or instructor number for a specific period such as a quarter or a semester. Consequently, if

FIGURE D-1

CAMPUS-MINNESOTA AND A UNIVERSITY INFORMATION SYSTEM



*Staff data has been shown in more detail as an example

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one is interested in analyzing the activities for a particular period, the file for that period is scanned. Through the use of home pointers each history file can be tied to the header information in the parent file. If one is interested in processing information by instructor or by activity, the master files containing this data are scanned, and the history for each master is obtained by traversing the history chain on each master.

CREATING STAFF 01 AND XSTAFF 01

STAFF 01 would be generated through the use of a master skeleton file that would contain rank code, rank name, weekly staffing units and office space. Average salary would be obtained by scanning the current quarter history file on instructor.

CREATING STAFF 02 AND XSTAFF 02

The activity history file would be scanned to obtain the number of hours required on the average to teach an activity by type and by department. This information can be used to generate the credit per contact hour used on the STAFF 02 inputs.

CREATING STAFF 03 AND XSTAFF 03

The non-teaching activity history file would be scanned to obtain summary data on the average hours spent per week by type of non-teaching activity. Factors for administration could be generated by making adjustments for the amount of staff assigned specifically to administrative tasks by scanning the instructor file for assignments.

CREATING XSTAFF 04

This input would be generated by obtaining the initial inventory from the instructor file. The hiring code, transition criteria and rank distribution would be maintained on a skeleton file which can be easily changed.

CREATING XSTAFF 05

The XSTAFF 05 input to the model would come completely from a skeleton file that would be changed only when one wanted to change staffing optimization policy.

MASTER FILES

Instructor File (Direct on Instructor Number)

Instructor Number
Name
Social Security Number
Specialty Type (Hegis Code)
Department or Budget Number (May have multiple occurances)
Percent Assigned (May have multiple occurances)
Demographic Data (WICHE Data Elements)
Rank and Tenure History
History Chain
Department Chain
Alpha Chain

Instructor Activity History (Stored by Period in Instructor Sequence)

Salary
Activity Pointer (15)
Home Pointer (Instructor Number)
Next History Pointer

Activity File (Direct on Activity Number)

Activity Number
Activity Name
Department Number
Department Name
HEGIS Code
Level of the Course
Specialty type required
Resource Requirement
Credits
Contact Hours
Section Size Characteristics
Schedule Chain
History Chain
Department Chain

Activity History File (Stored by Period in Activity Sequence)

Sections
Students
Instructor Number
Other Contact Hours
Preparation Hours
Evaluation Hours
Home Pointer (Activity Number)
Next History Pointer

Non-Teaching Activity File (Direct on Activity Number)

Activity Number
Activity Name
Non-teaching Activity Code
Next History Pointer

Non-Teaching Activity History (Stored in Activity Sequence by Quarter)

Instructor Number
Hours
Budget Number
Output Measures
    Number of Addresses
    Number of Reports
    Number of Papers
    Article Pages
    Book Pages
Home Pointer (Activity Number)
Next History Pointer

Schedule File (Stored in Activity Sequence by Quarter)

Activity Number
Section
Day, Hour, Room (May have multiple occurances)
Instructor Number (May have multiple occurances)

Student File (Index Sequential)

Student ID Number
Demographic Data
History Chain
Alpha Chain

Student History File (Stored by Period in Sequence by Student ID)

Activity Number
Grade
Home Pointer
Next History Pointer

APPENDIX E

EDIT PROGRAM DESCRIPTION

Project PRIME
Faculty Activity Analysis
\- Edit Program -

The edit program was set up as a series of small routines. The first section of the program read in parameter cards to set up the category numbers and the summary control limits. The category numbers are used to check the numbers that are keypunched to make sure they are legal numbers. The summary control limits specify the specific category numbers to be added together to obtain summaries on major categories.

The chart in Figure E-1 defines the general set of subroutines in the program. Figure E-2 contains the formats for the input cards.

Process control controls the reading of cards and the selection of the process for each card to follow. It also controls when to summarize individual totals.

Each of the other routines can be called and used by any of the routines as appropriate.

The error routine is one of the most important functions of the program. While processing any card, any errors detected are stored until the next card is read. The errors are then formatted and printed. The error messages possible are:

1. No Card 1 or No Card 5.
2. No Card 2.
3. Incorrect Category Number.
4. Incorrect Point Number 1-15.
5. Time Error - Non Ascending.
6. No Category for Point.
7. Incorrect Category Number.
8. Possible Error - Large Logged Hours.
9. Bad Data Format.
10. Bad Time.

The end routine prints out grand totals and overall summaries.

FIGURE E-1

EDIT PROGRAM SUB-FUNCTIONS

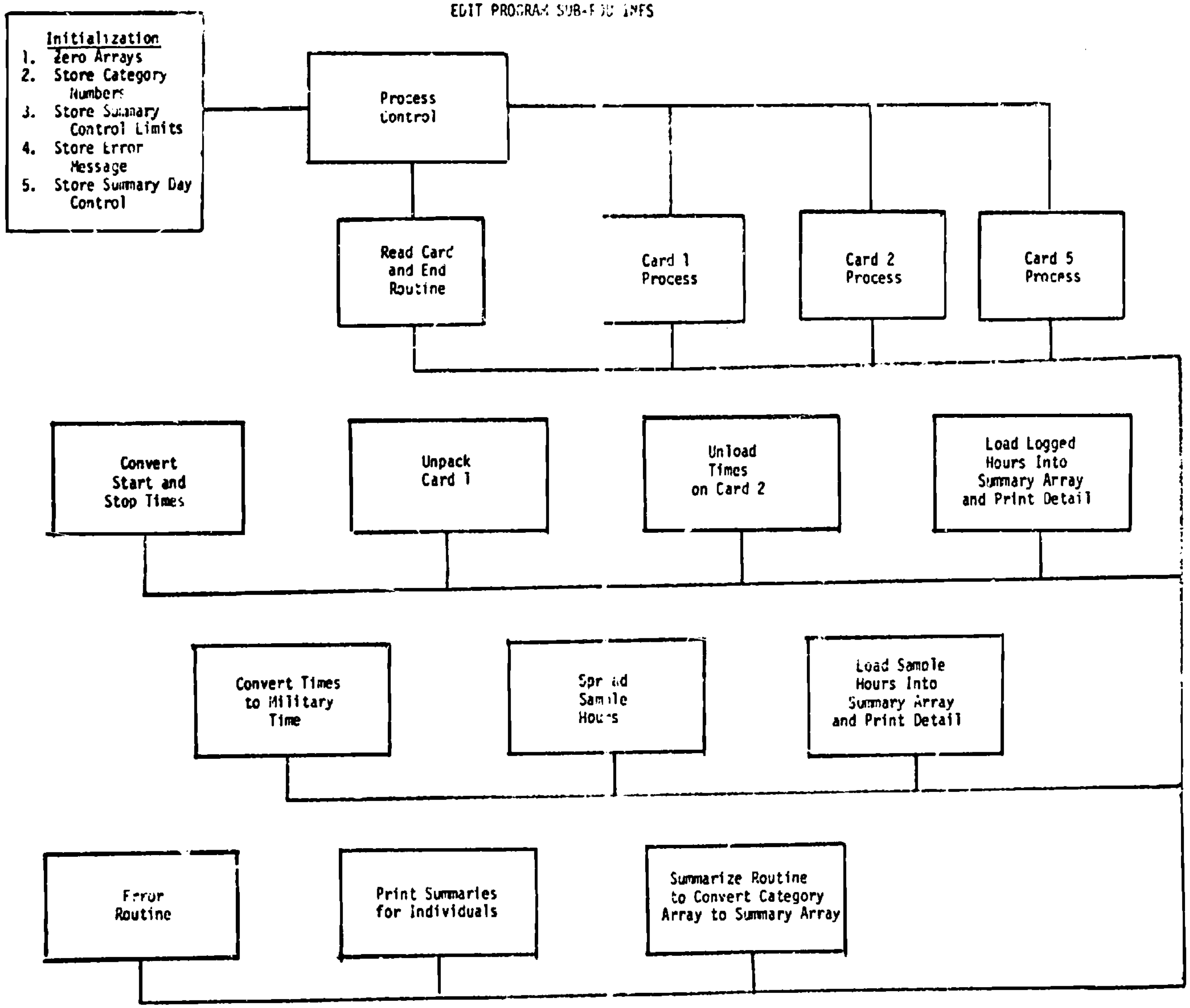
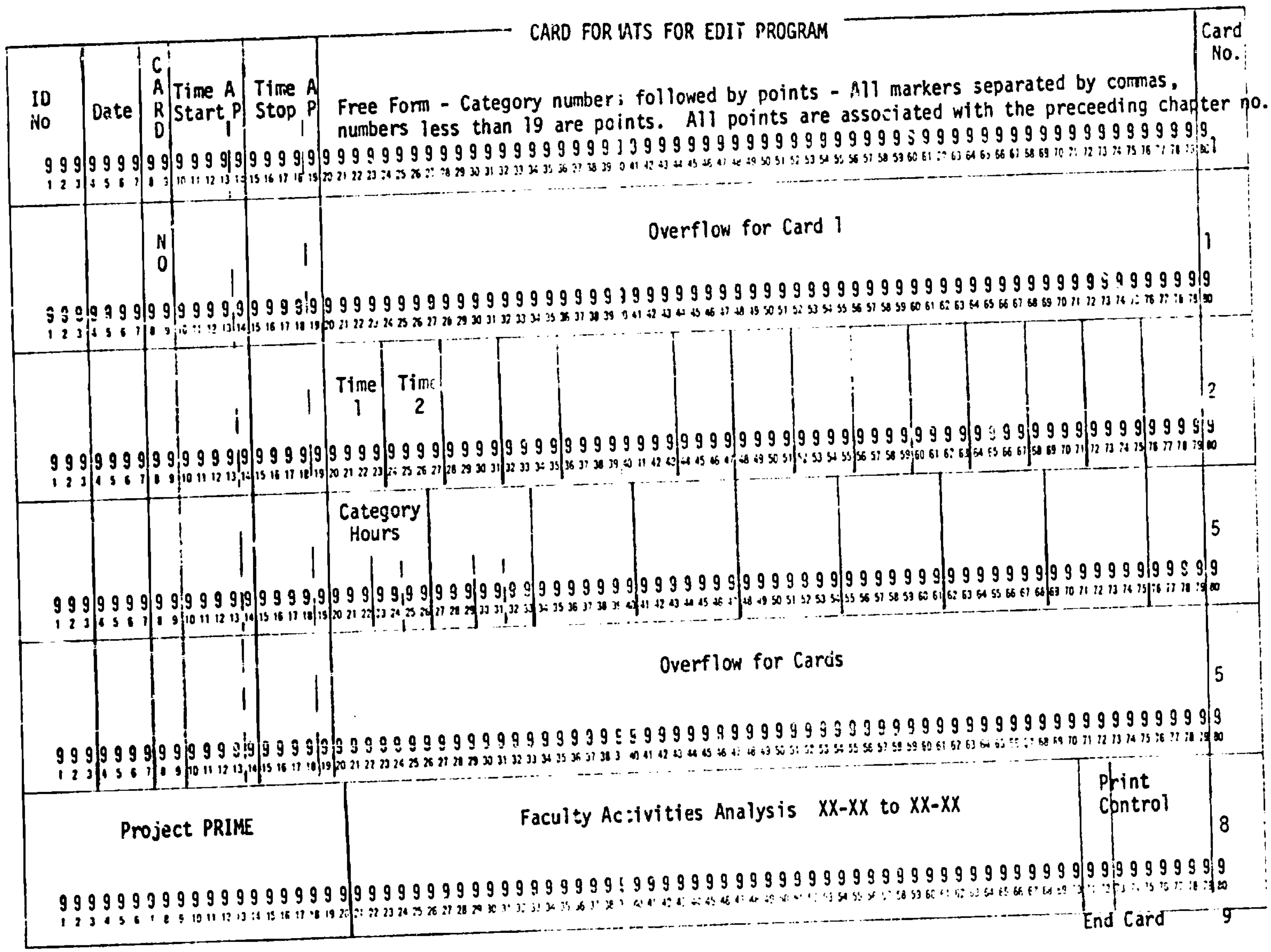


FIGURE E-2


CARD FORMATS FOR EDIT PROGRAM
Card No.
ID No
Date
CARD
Time Start AP
Time Stop AP
Free Form - Category number; followed by points - All markers separated by commas, numbers less than 19 are points. All points are associated with the preceeding chapter no.
Overflow for Card 1
NO
1
Time 1
Time 2
2
Category Hours
5
Overflow for Cards
5
Project PRIME
Faculty Activities Analysis XX-XX to XX-XX
Print Control
8
End Card
9

APPENDIX F

HOW RANDOM TIME SAMPLING WORKS

How Random Time Sampling Works*

The chart in figure F-1 is a helpful diagram to illustrate the principle of time sampling. The first line represents some time interval T. The second line shows the same time interval, but with the duration of activity A added. The third line shows the time interval T broken up into M instants of time. Line four shows that M_A of the M instants are during activity A. Line five is a random sample of m instants drawn from the M possible instants. Line six shows that out of the m instants m_A instants are associated with activity A. The population value of the proportion of time P associated with activity A is

$$P = \frac{T_A}{T}$$

The expected value of the proportion derived from enumerable instants is the same as the proportion derived from the continuous time variable.

$$\frac{M_A}{M} = \frac{T_A}{T}$$

Durations are equated to instants. An unbiased estimate of P is obtained by drawing at random m instants from all M instants. The proportion

$$p = \frac{m_A}{m}$$

is unbiased in the sense that its expected value is

$$\frac{M_A}{M} = P_M.$$

Therefore

$$\frac{m_A}{m} = \frac{M_A}{M} = \frac{T_A}{T} = P.$$

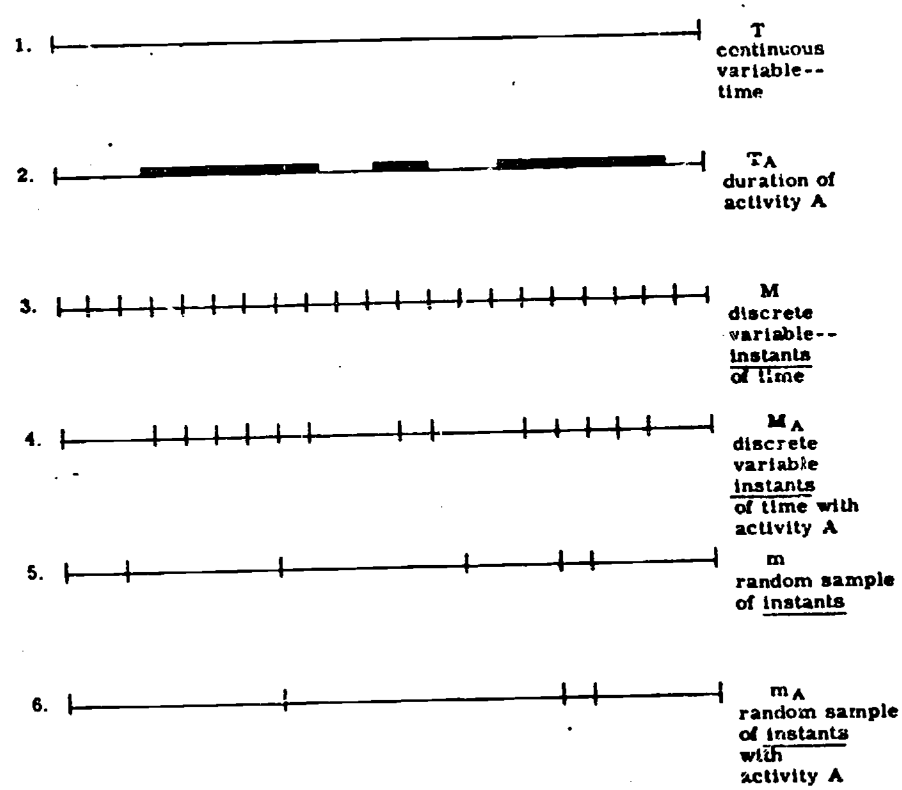
A numerical example will help to illustrate the previous formulas.

*[Hansen, 1960: 210]

FIGURE F-1

THE RANDOM TIME SAMPLING MODEL -

INSTANTS



[Hansen, 1960: 211]

Suppose there are 60 faculty who work on the average 54 hours per week. Over a 12 week quarter this would accumulate to 2,332,800 faculty minutes [60(60 x 54 x 12)]. Now assume that a chip is prepared for each of these faculty minutes indicating the presence of an activity. The chips are thoroughly mixed and 5000 are drawn at random. Out of the 5000 chips, 500 are research and 4500 are some other activity. The characteristics of the binomial distribution can be applied to this problem.

1. $p = \frac{500}{5000} = .10$

2. $S_p = \sqrt{\frac{.10 \times (1-.10)}{5000}} = .00425$

3. $p \pm 2(Sp) = .10 \pm .0085$

   $.0915$ to $.1085$

The first equation shows that the proportion of time spent on research is .10 or ten per cent. The second equation derived the standard deviation. The third equation uses the standard deviation to set up the 95 per cent confidence interval around the mean. The mean hours per week spent on research is 5.4 (.10 x 54). The 95 per cent confidence interval is 5.4 ± .46 (.0085 x 54) or 4.94 to 5.86.

APPENDIX G

FACULTY LOAD FORMULA STUDIES

FACULTY LOAD FORMULA STUDIES

HAUCK STUDY: Hauck sets up the following formula to measure time spent on course work.

$$T = T_p + N_c T_c + N_s T_s$$

where

T_p = Time spent in preparation

T_c = Time spent in calss

T_s = Time spent in instruction outside of class

N_c = Number of sections

N_s = Number of students [Hauck, 1969: 117]

Questionnaires, log data, sampling and conferences can be used by the faculty to develop T_p, T_c, and T_s. T_c is usually equal to the credit hours of the course. $T_p + N_s T_s$ is usually equal to twice this amount. Based on a study Hauck did at Tri-State College, the following mean time parameters were developed.

T_p = 1.53 per credit hour per week

T_c = 1.00 per credit hour per week

T_s = .10 per credit hour per week

Consequently, a three credit course with 50 students would be

$$\begin{aligned} T &= (T_p + T_c N_c + T_s S_s)*3 \\ &= (1.53 + 1.0(1) +.10(50))*3 \\ &= 22.59 \text{ Hours per week} \end{aligned}$$

If one were teaching 3 courses of 35 students each and had an average of 8.4 hours per week in extra activities, a faculty member's time would average about 63 hours per week. The value for T_s is a sensitive variable and appears to be rather high. T_s will generally decrease as N_s increases, and it will also vary with the particular course. Since T_s represents the coefficient applied

to the variable "students", it should include grading time as well as instruction outside of class.

HILL STUDY: An approach toward equivalent measures is reported by Hill. He introduces the equivalent student credit hour (ESCH).

$$ESCH = L + 1.85U + 4.0G + 2m + 12M$$

where

L = lower division credit hours taught
U = upper division credit hours taught
G = graduate student credit hours taught
m = number of undergraduate majors
M = number of graduate majors [Hill, 1969: 92]

This formula uses lower division credit hours as the base (i.e., 1 credit hour = 1.0). It gives extra weight to upperdivision credits, graduate credits, and to the number of majors at the undergradute and graduate levels. Time in hours can be generated by multiplying ESCH by the number of hours it takes to produce one undergraduate credit. This formula assumes that class sizes do not change much within level. Hill indicates that this formula is useful for watching changes in load over time within a department as well as comparing departments with equivalent mixes. It is also useful for coming up with equivalent student teacher ratios as opposed to just student teacher ratios.

BANKS STUDY: Banks in a study for his master's thesis at Alabama sets up the following formula.

$$\text{Total load} = H + \Sigma y_1 + \Sigma y_2 + NT_T + tN_t + CN_a + A + D + S + I$$

where

H = Contact Hours

Σy_1 = Total course preparation time

Σy_2 = Total grading time

TN_T = Time factor * Number of Active Thesis

tN_t = Time factor * Number of Inactive Thesis

CN_a = Time factor * Number of Committee Appointments

A = Administration

D = Personal Development

S = Student Counseling

I = Personal Delay [Banks, 1963: 23]

Course preparation (y_1) and grading time (y_2) is broken down further as a function of the following:

1. Course content
   a) percent of course pertaining to philosophy
   b) percent of course pertaining to theory
   c) percent of course pertaining to design
   d) percent of course pertaining to problems
2. Contact hours
3. Semesters of experience
4. Number of students enrolled

Banks summarizes the alternatives for evaluating and measuring faculty load.

1. Use semester credit hours as a base (i.e., 12 semester hours). Undergraduate is weighted 1.0, labs, .5 and graduate 2.0. No credit is given for other activities.
2. Use the 12 hour base, but base credits on the study of accredited engineering schools. Undergraduate is weighted 1.0, graduate 1.125, labs, .67, thesis supervision .75 per thesis and some allowance for personal development.
3. Use the full regression equation base on coefficients derived through a sample taken at the school. Based on a sample taken at the University of Alabama, School of Engineering, the following values were used.

Committees	. 7 hours/week/appointment
Active thesis supervision	1.39 hours/week/thesis
Inactive thesis supervision	.55 hours/week/thesis
General administration	3.52 hours/week
Personal counseling	3.15 hours/week
Student counseling	3.80 hours/week
Personal activity	2.81 hours/week

Using these parameters along with the regression coefficients used to develop preparation time and grading time, the average work week in his study was 54.39 hours.

POWELL STUDY: Powell in his study for his masters degree at Virginia Polytechnic Institute experimented with formulas similar to Banks. He studied the effects of various independent variables on load such as (a) changes in undergraduate enrollment, (b) changes in graduate enrollment, (c) changes in extension participation by faculty members and (d) changes in sponsered research undertaken by faculty members. Powell's faculty workload algorithm is based on the following variables.

1. Courses including first section of a course with X or less students that is taught by a faculty member.
2. Courses including first section of a course with X + 1 or more students that is taught by a faculty member.
3. Second and succeeding sections of multiple section courses.
4. Laboratory courses run by a faculty member.
5. Advising undergraduate or graduate students.
6. Advising professional or honorary organizations.
7. Directing master's thesis.
8. Directing doctoral dissertations.
9. Committee on special assignments.
10. Administrative tasks.
11. Research and extension projects [Powell, 1967: 15]

HENLE STUDY: Henle's work "Systems for Measuring and Reporting the Resources and Activities of Colleges and Universities" develops an extensive formula that takes into consideration his concepts referenced earlier in this chapter pertaining to joint activities. Henle sets up four formulas for different functions.

1. For teaching, including educational administration and Intra-University Activities.

$$K = C + \Sigma w_i c_i + w_r . n$$

$$I_T = \frac{KT}{t}$$

2. For research and creative activity including their administration.

$$I_R = L + P + C + A$$

3. For teaching - Research, Teaching through Creative Activity, and thesis direction.

$$I_{T-R} = w_N . N$$

4. For Public Service

$$I_S = S$$

The individual's activities index is

$$I - I_T + I_R + I_{T-R} + I_S$$

The definitions of the symbols follow.

c = number of contact hours per week in class, laboratory, or design plus formal consultation periods

c_i = number of contact hours per week in class, excluding laboratory or design for which separate preparation is needed

w_i = weight factor to represent preparation for different level classes, obtained from institutional data

k = number of different subjects requiring preparation

n = total number of students in class, laboratory or design

w_n = weight factor obtained by averaging the W_j for different level classes or proportional thereto

N = total number of students in Teaching-Research or being taught through Creative Activity in Art and Scholarship, and whose theses are being directed

w_N = weight factor for each student included in N; it may be obtained by averaging the w_i above, by sampling the faculty, or from institutional data, being proportional thereto

L = number of hours per week spent in laboratory, library, or studio on Research or Creative Activity in Art and Scholarship

P = number of hours per week spent in writing papers, proposals, or reports

C = number of hours per week spent in consultation with sponsors or authorities in the area of Research or of Creative Activity in Art and Scholarship

A = number of hours per week spent in administration of Research or of Creative Activity in Art and Scholarship

S = number of hours per week spent in Public Service

T = total percent of time (or effort) spent on Teaching, Administration (excluding Research) and Intra-University Activities

t = percent of time (or effort) spent on Teaching

I_T = index for Teaching

I_{T-R} = index for Teaching-Research and Teaching through Creative Activity in Art and Scholarship

I_R = index for Research and Creative Activity in Art and Scholarship

I_S = index for Public Service

I = faculty member's activity index. [Henle, 1967: 295-6]

MILLER STUDY: Another extensive study on formulas was done by Kermitt Miller as part of his Ph.D. dissertation at the University of Mississippi. Miller sets up a rationale for measuring faculty load which not only includes a factor for time, but also includes factors for responsibility and ability. He suggests a measuring system which consists of two measures, one of time and the other a mean of the

weights assigned to the factors "responsibility" and "ability". He calls this mean the "X" measure. The product of these two measures (Time and "X") is used as an index number to measure the amount of load derived from a specific component. Miller defines the weights as follows:

> The weights assigned the ability factor and the responsibility factor are both 1.0 for the tasks involved in producing a lower division class credit hour. Therefore, other components are assigned values greater than, less than, or equal to 1.0 for the factor according to how the responsibility involved and ability required for the component is judged to compare with that for producing a lower division class credit hour. The time measure is based on the number of hours per week during a semester that a faculty member would be expected to spend in performing the tasks related to a component.

Miller's work load formula is:

$$L_i + \sum_{j=1}^{J} X_{ij} \cdot T_{ij}$$

where

j = a specific application of the formula to a component i.e., the formula can be applied 3 times on one component because there are 3 occurences of that component.

i = The component of faculty load (Miller lists 25, see Figure 2.8)

X = "X" factor

T = Time factor

L = Load

The load of a particular faculty member is

$$L_f = \sum_{i=1}^{25} L_i$$

and the load of a department is

$$\Sigma(\Sigma L_f)$$

where F is total faculty in the department. Miller goes on to develop "X" values and T values for all of the 25 components. These values are summarized in Figure G-1.

The problem with using these formulas is that the data is not always available to apply the formula. However, as better data systems are developed to collect and maintain activity data, these formulas will be useful in transforming the data base into meaningful information for decision making.

SWANSON STUDY: Full Time Equivalent Hours (FTE) for the (i)th staff member is defined as the algebraic sum of the hours a full time equivalent staff member expects to spend on formal educational duties. As such it will include the number of hours spent in a classroom (H), preparation time (P), and advising time (A), all expressed as a proportion or percent of total full time employment. Assuming that variables P and A are set by negotiation with the department involved, the generating function for full time equivalent staff members is given by:

$$FTE_a = \Sigma(\frac{H}{h} * NS + P + A * NA)$$

where

H = Hours in the classroom
P = Preparation time
A = Advising time per student
n = Number of section taught
NS = Number of students in each section
NA = Number of students if acting as a special advisor
h = Number of hours that constitute a normal work week.
[Swanson, 1966: 28]

FIGURE G-1

COMPONENT FORMULAS, THE TIME MEASURES, AND MEAN FOR THE X MEASURE FOR THE COMPONENTS OF FACULTY WORK LOAD*

Component Number	Task	X Measure Mean	Time Measure Hours Per Week
1_a	Semester Hour Lower Division (New Preparation)	1.0	4.0
1_b	Semester Hour Lower Division (No New Preparation)	1.0	2.0
2_a	Semester Hour Upper Division (New Preparation	1.1	4.5
2_b	Semester Hour Upper Division (No New Preparation)	1.1	2.5
3_a	Semester Hour Graduate Division (New Preparation)	1.2	5.0
3_b	Semester Hour Graduate Division (No New Preparation)	1.2	2.8
4	Laboratory Hour Spent in Scheduled Laboratory Time Per Week	1.0	2.4
5	Semester Hour--Seminar	1.2	3.0
6	Number of Students Per Class Over 40	X_6	$T_6\sqrt{\frac{N}{40}}$
7	Design a Course of Study for a Correspondence Course	1.2	4.0
8.	Teach One Student by Correspondence	.9	.15
9_a	Student Undergraduate Advisee	1.0	.05
9_b	Student Graduate Advisee	1.2	.10
10	Direct a Masters Thesis	1.5	3.5
11	Direct a Doctoral Dissertation	2.0	5.5
12_a	A Committee Membership for a Thesis	1.3	1.2
12_b	A Committee Membership for a Dissertation	1.6	2.0
13	Official Counselor for a Student Organization	1.2	0.7
14	Membership on an Institution's Committee	1.2	T_{14}
15	Chairmanship on an Institution's Committee	1.4	T_{15}
16	Department Chairman - Small	1.5	8.0
	Medium	1.5	12.0
	Large	1.5	16.0
17	Supervising an Employee	1.3	T_{17}
18_a	Other Major Office in a Professional Organization	1.5	T_{18a}
18_b	Other Major Office in a Professional Organization	1.3	T_{18b}
19	Research	1.7	T_{19j}
20	Publication	1.5	T_{20j}
21	Travel on Institutional Related Business	0.8	T_{21j}
22	Consultant Work	1.5	T_{22j}
23	Public Relations (Speeches, Visits, etc.)	1.2	T_{23j}
24	Speech to Professional Group	1.3	T_{24j}
25	Attendance of Meetings	0.9	T_{25j}

*[Miller, 1968: 70-71]

APPENDIX H

UNIT AND PROGRAM COST STUDIES

UNIT AND PROGRAM COST STUDIES

California and Western Conference - Cost and Statistical Study: This study included Indiana University, the State University of Iowa, Mighigan State University, the University of Minnesota, Purdue University, Pennsylvania State University and the University of Washington. Vanderbilt and Wabash College were also included to represent a segment of the private institutions. The primary purposes of the study were to: (1) develop techniques of cost analysis which would generally be applicable to all institutions of higher learning, (2) to provide the participating institutions, through application of the above techniques, with data for comparison, interrelation, and interpretation among and within institutions, and (3) to initiate a continuing study among the ten institutions whereby such data and ideas might be exchanged each year. The conclusions of this study are as follows:

1. High or low unit costs are not peculiar to specific subject fields, institutions or methods of instruction. The same basic factors affect costs in all subject fields, in all institutions, and at all levels of instruction.

2. In the institutions studies, the number of weekly student-class-hours per FTE teaching staff member is the most important factor in explaining variations in unit costs. This is basically a measure of teaching assignment; it also reflects class size. A generalized conclusion may be drawn that unit costs can be most easily changed by changing the ratio of students to staff in the specific subject field. The effect of such changes upon the learning environment is not, however, taken into account.

3. Total volume of teaching activity, if extremely low, prevents much increase in class size or teaching load, thus making cost adjustments difficult.

4. Cost per student is affected not only by the number of students, but also by the composition of the student body in terms of instructional level, curriculum, and so on: the so-called "student mix."

5. Teaching salaries do not appear to be related to cost per student in the participating institutions because other factors are of greater weight. Thus, it is possible to raise academic salaries and reduce unit costs at the same time.

6. Other teaching costs show no general relation to teaching-salary costs. In some areas, however, they are significant factors in over-all expenditure.

7. Methods of instruction definitely affect cost. Their effect, however, is in terms of their influence upon class size, teaching load, and other factors bearing upon costs. Where the measure of cost is indicated in terms of the student-class-hour per week, attention must also be given to the number of weekly meetings of the class. [California and Western Conference, 1960: 10].

WALDO ANDERSON STUDY: Anderson's study at Kansas dealt primarily with instructional salary costs per student semester credit hour. The purpose of the study was to determine the nature of costs by subject field and by other factors such as different institutions, rank of faculty, class size, level of instruction and type of instruction. The intent was to obtain a profile of the behavior of costs so that it could be used for planning purposes. The findings of the study were as follows:

1. Considerable variation in unit costs was found to exist between the different institutional types, but much less between institutions within a given type category.

2. Rank of faculty members appeared to have an important but less significant effect on instructional salary costs.

3. The variable of class size produced a marked difference in cost from one class size to another.

4. Level of instruction also had a dominant effect on the unit costs of instruction examined in the study.

5. Significant differences were observed to exist between instructional costs as taught under differing instructional arrangements.

6. The investigation of cost differences between subject fields revealed significant differences attributable to subject field. [Anderson, W., 1963: 128-132]

ERNEST ANDERSON STUDY: Ernest Anderson's study on Junior colleges in Illinois was done to provide knowledge about the variable costs of curricula to assist the State of Illinois in planning for the approval of programs. The findings were used as a base in projecting financial costs for statewide policy making as the state moved into the development of a system of junior colleges. The study was based on eight junior colleges in Illinois. Data was obtained to develop (1) direct salary cost per student credit hour for each course, (2) supportive teaching cost per student credit hour for each course, (3) total cost per student credit hour for each course, (4) total cost of educating a student in each curriculum offered, (5) average cost of educating a student in the liberal arts and transfer curricula, and (6) average cost of educating a student in each of eight categories of vocational and technical curricula. [Anderson, E.F., 1966: 89]

GERBER STUDY: Gerber's study was done in 1968 on the junior colleges in Minnesota. The objectives of Gerber's study were to determine (1) the manner in which the instructor's in the Minnesota State Junior College system spent their time, (2) what they perceived as the ideal use of their time, (3) what the nature of their workload was, and (4) based on salaries what the unit cost of instruction

was. [Gerber, 1968: 4]

Gerber derived unit costs by dividing the total teaching salary expenditure in a given subject field and college classification by the total student quarter credit hours output for the same subject field and college classification. His study came up with the following figures. [Gerber, 1968: 169]

Technical education	$15.19
Business	9.36
Physical Sciences	9.28
Humanities	8.81
Mathematics	8.28
Physical Education	7.88
English	7.80
Biological Sciences	6.37
Social Sciences	5.27

THE OHIO STUDY: A recent comprehensive faculty load study has just been completed on higher education in the State of Ohio by the Inter University Council of Ohio Faculty - Workload Committee [Ohio, 1970] This committee had been asked to "propose guidelines for establishing the amount and kind of service state university faculty members should be expected to give in performance of their contracts with the universities". [Inter University Council of Ohio, 1970: 1] The following tasks were completed as a part of the study.

1. Review research into faculty workload
   a. Nationally from 1922 to 1959
   b. Ohio
2. Develop comparisons of workload measures
   a. National
   b. Ohio
3. Develop quantitative expressions of university activities in support of the instructional, research, and public service processes, the sponsorship of these processes and faculty effort in support of these processes.
   a. A model of the University environment
   b. The work and sponsorship of that work at state assisted universities in Ohio.

4. Develop recommended guidelines for faculty workload
   a. Guidelines for faculty workload
   b. Measuring and evaluating performance

The tasks represent an energetic effort. The degree to which they were accomplished is difficult to access. The committee exercised a considerable amount of effort to accomplish the output in the report.

A significant aspect of the study is the format they used to structure the data. The format called "The University Environment" is a programatic structure that is almost the same as the WICHE program classification structure. Figure H-1 shows the structure that was used in the study. The data used in the study had been gathered over a four year period in a common format in support of the Ohio Board of Regents Uniform Information System. Faculty service data was used to restructure the final data into the format of the "University Environment". The results of these allocations of all current financial activity were summarized by type of service (Primary, Academic Environment Support, General Support) and by process reviewed (Instruction, Research and Public Service). [Inter University Council of Ohio, 1970: 27]

The committee found that the overall work of the state assisted universities differs greatly both with respect to the proportion of effort devoted to different types of services provided and with respect to proportionate effort in favor of the Instructional, Research and Public Service Process.

The general conclusions of the overall study are as follows: [Inter University Council of Ohio, 1970: 2-5]

FIGURE H-1

THE UNIVERSITY ENVIRONMENT*

I. PRIMARY ACADEMIC SERVICES

Augment and promulgate knowledge through instruction, research and public service activities

A. INSTRUCTION

1. Organized Teaching of Degree Credit Courses In Academic Departments at Various Levels
2. Advising and Counseling In Academic Departments at Various Levels
   a. Major Program Advisors
   b. Graduate Reading Committees
3. Provision of Professional Training Facilities
   a. Demonstration Schools
   b. Farms, Dairies, Creameries, Foundaries, Shops
   c. Theatre Workshops
   d. Clinics and Counseling Services
   e. Airport

B. RESEARCH, CREATIVE WORK AND DEVELOPMENT

1. Research and Creative Projects
2. Development
   a. Non-Project Research
   b. Professional Development Curriculum Development
3. Provision of Specialized Facilities for Research and Creative Activities
   a. Survey Research Center
   b. Research Farms
   c. Nuclear Reactors
   d. Faculty Studies

C. PUBLIC SERVICE

1. Non Degree Credit Instructional Programs
   a. Forums, Workshops Seminars
   b. Specialized Training Programs
2. Dissemination of Knowledge Through Other Than Organized Teaching
   a. Agricultural Extension
   b. Community T.V. and Radio
   c. Scholarly Journals and Consulting
   d. Cultural Activities and Museums
3. Regulation and Inspection Services
   a. Soils and Materials Testing
   b. Professional Licensing
   c. Dairy Herd Testing
4. University Hospitals

II. ACADEMIC ENVIRONMENT SUPPORT SERVICES

Direct Support to the primary services through students and learning services

B. LEARNING RESOURCES

1. Library Services
2. Provision of Specialized Learning Facilities for General Use
   a. Computing Center
   b. Language Listening Center
3. Production of Specialized Learning Services for General Use
   a. Maintenance
   b. Construction

A. STUDENT SERVICES

1. Health, Care and Subsistence
   a. Dorm
   b. Food
   c. Health
   d. Counseling
3. Financial Support
   a. Scholarships
   b. Loans
   c. Fee Waivers
   d. Work Study
3. Extra Curricular Services
   a. Athletics
   b. Activities
   c. Alumni

III. GENERAL SUPPORT SERVICES

General administrative services, support facilities and physical plant

GENERAL SUPPORT

1. General Administration
   a. Administrative Units
   b. Promotion
   c. General Expenses
2. Provision of Support Facilities
   a. Bookstores
   b. Laundry
   c. Data Processing
   d. General Stores
3. Maintenance and Construction of Plant
   a. Maintenance
   b. Construction

*[Inter University Council of Ohio, 1970: 25]

1. Historical - Over 100 studies nationally and a detailed analysis of Ohio data indicate that a teacher works more than forty hours per week in performance of his duties. The average is somewhat better than fifty hours per week. Efforts to develop comparisons of workload based on credit hours, classroom contact hours, or student credit hours have not yielded much for myriad reasons.

2. Comparisons - nationally, the state assisted universitites perform rather well, producing 3% of the nation's graduates at 2.4% of what the nation spends on higher education. This differential of twenty-five percent represents a favorable cost difference of over 125 million dollars.

   These same universities have 4.4% of all students enrolled in public universities in this country and receive only 3.3% of the national total of state appropriations to universities. This represents a 33% differential in costs borne by the state. In short, in so far as national data on students (enrollments, degrees) represents output, the twelve state assisted universities produce this output at total cost that is roughly 25% lower than the national average cost with costs to the state that are about 33% lower than at the average public university.

   Traditional statistics of credit hour load, classroom contact hour load and student credit hour loads at the universities, when subjected to thorough analysis, do not provide for meaningful comparisons. The variances among institutions, within institutions and even between similar programs (e.g., Engineering, Physical Sciences) at different institutions are, while explainable, so large as to render them useless in the development of statewide guidelines.

3. Analysis of Processes at the Universities - The study reveals that a comprehensive model of activities in support of the instructional, research and public service processes at the state assisted universities does provide a valid basis for understanding the unique contribution of each institution to higher education. When supplemented by an analysis of relative sponsorship of these processes the model provides a valid basis for developing guidelines that relate faculty effort to sponsor goals.

4. Guidelines to faculty workload - The study indicates that while faculty are expected to perform and do perform instructional research and public service duties at all institutions, regardless of funding, and that although there is great institutional variation with respect to the relative emphasis on instruction, research and public service, reliable guidelines as to relative amount of work can be established.

   Specifically, each state assisted university should devote at least 80% of the effort of its total faculty or an average of at least thirty-two hours per week on a full time equivalent basis, to the instructional process of that university except for those faculty who are on separately budgeted and separately funded research or public service projects. There are institutions which already devote larger proportions of faculty effort to instruction, however it appears reasonable to expect even the highly diversified universities to be able to achieve this guideline.

5. Methods for measuring and evaluating performance - Here the study finds that a system of individual faculty service reporting is essential as a basis for measuring performance. Further the study indicates that such a system must be sufficiently detailed to document the specific activities of each faculty member in support of the instructional, research and public service processes and the percentage of effort and amount of time allocated to each.

   Finally the study suggests that future work be undertaken to develop common guidelines for the assignment of specific activities among the processes of instruction, research and public service and for the development of "cost/benefit" measures that are useful for both intra and inter university comparison. [Inter University Council of Ohio, 1970: p. 2-5]

<u>WARREN GULKO STUDY:</u> Gulko's study is a methodological study defining unit costs in the educational environment. A major portion of the study describes the algebra of unit costs. The algebra provides a mathematical relationship between the variables of

discipline, course level, direct cost, number of students, total cost, average cost, and FTE student.

The study also takes into consideration indirect costs.

> The cost per degree-winner may be considered as consisting of three types of costs.
>
> a. The direct instructional cost incurred in generating the degree.
> b. The allocated support costs associated with the direct instructional costs.
> c. Indirect student support costs generated by virtue of the degree-winner being present in the system. [Gulko, 1971: 29]

Gulko goes on to discuss some of the problems of handling the costs of attrition (non degree winners), transfer students, both in and out, and transfers between program.

APPENDIX I

UNITED KINGDOM DIARY STUDY

The Committee of
Vice-Chancellors
and Principals of the
Universities
of the United Kingdom

ENQUIRY INTO THE USE OF TIME BY UNIVERSITY ACADEMIC STAFF

1969/70

№ 14059

HOW TO COMPLETE THE DIARY

The following notes have been prepared to assist all members of the academic staff who are being invited to complete returns about their use of time. Please take them into careful account in completing the diary.

Please mark by a cross (X) for each half-hour of each day, that one use of time which best represents how you used that half-hour. If you spent exactly 15 minutes on one use and exactly 15 minutes on another, choose one of the two at random; any error will be insignificant in the aggregate over members of staff in the subject group as a whole and for the full week.

There should be one cross on each line

We are sorry that parts of the day have to be included which, for nearly all respondents will be 'private time', but it is known that some members of staff do work unusual hours. It is for this reason that all days in a week, including Sunday, are covered in the survey. If work under the headings A to F is done outside the hours specified in the diary (8.00 a.m. to midnight) - for example night work on a computer - please record the relevant information in the space provided.

A: 'Undergraduate Time': This covers teaching and associated activities including the preparation of teaching material, laboratory supervision, examining, testing and marking essays, and also all work (including administrative and committee work and discussion with colleagues) on admissions, discipline, student advice, undergraduate curricula. Contacts with schools which

3

influence admissions should be included. Include here student social contacts which you regard as part of your 'work', and where any work, though benefiting graduate students, is predominantly concerned with undergraduates, use this column. If a meeting is partly concerned with undergraduate affairs and partly with other matters, make a rough allocation of half hours involved between different columns. External examining goes under F.

B: 'Graduate Course-Work Time': As in A, but predominantly related to students in those higher degree courses or parts of courses in which the main weight is on instruction rather than research, except that, if the instruction is confined to the techniques required for a specific research project, column C should be used.

C: 'Graduate Research Time': As in A, but predominantly related to students for higher degrees whose main work is research. Include all forms of research training, project assistance, supervision and examining of students in your own University.

D: 'Personal Research Time': This covers all time spent on, or predominantly contributing to, your personal research or co-operative research in which you are involved. Include the administration of research. Those engaged in co-operative work with graduate students should include in this column time spent in planning, leading or administering projects or in writing up results, and in Column C time spent in supervising the graduate students. If in doubt, allocate to C or D at random: the report on the survey will make it clear that this is an area where exact demarcation is

4

impossible.

E: 'Unallocable Internal Time': This is time spent on reading, study, discussion and conferences which, while possibly contributing both to teaching and research is not allocable to one or the other. Time spent 'keeping up with the subject' should be entered here. Include also any administration and committee work not allocable to undergraduates, graduates or personal research - for instance, [illegible] and the general supervision of a department - and work related to the building up of a library, unless the books concerned are ordered for particular student groups (A or B) or a particular piece of research (C or D).

F: 'External Professional Time': This is time spent on consultancy, industrial projects, committee work outside the university, [illegible] work, outside lecturing, external examining, writing [illegible] textbooks, refereeing papers for learned journals, and all other work which is related to, and may, in principle at least contribute to your professional status in the wider field. Include here also work with extra-mural students, and the preparation of films, videotapes, etc. for use outside your own University.

'Private and Free Time': (the last column) covers eating, recreation, sleeping, family contacts, work for the community not related to your professional status (e.g. being a churchwarden), non-productive travel time to and from your normal place of work (but travelling on official business should be included under the category to which the business belongs), marking school examination papers, writing novels as a spare-time occupation, and other such activities which, while

5

'work', neither derive from your university post nor contribute to your professional status in that post.

Sickness: Members of the academic staff who are invited to participate in the project but who are sick through the whole of a week of survey are not expected to maintain records, although it would be helpful for the blank diary to be returned to the Registrar with an indication of the reason for non-completion. In cases where respondents are sick for a short period, say two or three days in the course of a survey week, the fact should be recorded on the relevant named daily page(s) in the diary.

You will find in this diary a separate sheet for each of the seven days of the enquiry week. Each sheet has a named day at the head of it. No dates are given, however, because the week of survey may differ from university to university. One additional daily record sheet without a named day heading is also provided. This should be used only in those cases where a named day record is spoiled. Should you find it necessary to substitute this 'reserve' daily record sheet please specify the day concerned at the head of the sheet.

You are invited to use the blank sheets, headed 'COMMENTS' at the back of the diary to record any points you may wish to make on the form of enquiry being used. These comments will be taken into careful account in the preparation of the general commentary to accompany the results of the whole project.

For this form of enquiry to be successful it will be very helpful if diary entries could be made say three or four times in the course of each day. In fact it should be

6

easier to complete the relevant parts of the diary at such intervals rather than attempting to remember what you did during particular hours of a day some time after the event. The diary has been produced in pocket-sized form to enable you to carry it with you through the week of survey.

All diaries on completion should be sealed with sellotape and returned to the University Registrar.

7

NOTES

Please refer to pages 3 to 7 for full information on the method of completing the diary and for a detailed description of the activities classified under the 'Major Use of Time' headings.

A 'Undergraduate Time'
B 'Graduate Course-Work Time'
C 'Graduate Research Time'
D 'Personal Research Time'
E 'Unallocable Internal Time'
F 'External Professional Time'
'Private and Free Time'

There should be one cross only on each line.

Time outside the period 8.00 a.m. to midnight will be assumed 'Private' unless you indicate below other 'work' periods (e.g. night computer sessions):

....

....

....

....

8

MONDAY .... (date)

half hours commencing	MAJOR USE OF TIME						
	A	B	C	D	E	F	'Private and Free Time'
8.00 a.m.							
8.30							
9.00							
9.30							
10.00							
10.30							
11.00							
11.30							
12.00 noon							
12.30 p.m.							
1.00							
1.30							
2.00							
2.30							
3.00							
3.30							
4.00							
4.30							
5.00							
5.30							
6.00							
6.30							
7.00							
7.30							
8.00							
8.30							
9.00							
9.30							
10.00							
10.30							
11.00							
11.30							

9

APPENDIX J

SELF SAMPLING STUDIES

SELF SAMPLING STUDIES

SCHANNE STUDY: A self sampling study was done in May 1967 by Frederick J. Schanne entitled, "Work Sampling-New Self Study Method Versus Traditional Method". The study was done with a librarian for a period of 12 days using the Maylan Random Signal Generator. The librarian sampled herself over a period of twelve days with the device set at a mean interval of 18 minutes. This produced about 300 observations. Schanne also took 300 observations over this same time as an independent observer. The categories and the results are shown in Figure J-1. Using a confidence interval based on an alpha value of .10 the "p" values developed on the self study data were all within range of the interval based on the data from the traditional method. Schanne summarized a few prolems with the self observation study. (1) Different people will interpret the same job activity categories in different ways. (2) The self studier must be honest with himself. (3) Being a slave to the device over a long period of time was annoying to the person sampling. (4) The study done was not a cyclic study. Further study should be done where the application is cyclic. (5) The device was cumbersome to carry around.

SCHMID STUDY: Another study was done at St. Mary's College in Winona on one faculty member for a week. The day was divided into 10 minute periods and randomly sampled. A walkie talkie was used to contact the faculty member and ask him what he was doing. He did not classify his own activity. The author was not able to obtain any write-up of the study. Giles Schmid, who is with the Office of

FIGURE J-1

FINAL RESULTS [300 SAMPLES]

CATEGORY	TRADITIONAL NO. TIMES OBSERVED	$\bar{P}_i$	METH. CALC. I	SELF-STUDY METH. NO. TIMES OBSERVED	$\bar{P}_i$	METH. CALC. I	CONFIDENCE INTERVAL BASED ON TRADITIONAL METHOD	IS SELF-STUDY ACCEPTABLE?
CURRENT CHECK LIST	10	.0330	.0339	13	.0433	.0382	.0161 to .0499	Yes
NEWSPAPERS	9	.0300	.0324		.0233	.0286	.0138 to .0462	Yes
BINDERY PREPARATION	2	.0067	.0155	1	.0033	.0108	0 to .01445	Yes
CHECK LIST	3	.0100	.0189	4	.0133	.0204	.0906 to .0195	Yes
TYPING	25	.0834	.0522	20	.0667	.0474	.057 to .1095	Yes
WORK IN FILES	75	.2500	.0824	66	.2200	.0786	.209 to .2912	Yes
GIVING INFORMATION	26	.0876	.0535	21	.0700	.0484	.061 to .1144	Yes
SORT AND SHELVE PERIODICALS	38	.1268	.0632	41	.1367	.0650	.095 to .1584	Yes
WALKING	10	.0330	.0339	11	.0367	.0362	.016 to .0499	Yes
PHONE	3	.0100	.0189	2	.0067	.0156	.001 to .0195	Yes
READING	11	.0367	.0606	15	.0500	.0414	.006 to .067	Yes
IDLE	21	.0700	.0484	26	.0876	.0530	.046 to .0942	Yes
MISCELLANEOUS	67	.2230	.0790	73	.2430	.0812	.184 to .2625	Yes
TOTAL	300	1.00		300	1.00			

[Schanne]

Planning and Evaluation*, indicated in a letter to the author that the main problems were to set up categories that were mutually exclusive.

CARROLL AND TAYLOR STUDIES: A study was done at the U.S. Naval Weapons Station in Charleston, South Carolina to determine the validity of the self-observation method of work sampling by comparing the time allocations determined by this method with the time allocations determined by the independent observation method. The study was done over a two week period using 16 observations per day for both methods. The eight hour day was stratified into hours, and two observation points were randomly selected out of each hour with a mimimum of five minutes between points. It was found after four days that the personnel were becoming aware of the two times per hour. Consequently, the times for the remainder of the study were not stratified per hour and were randomly selected over the day.

The points were given to the participants in the study through a central signaling method. The lights were flicked off and on for each point that an observation was to be taken.** All sixteen employees placed a check mark in the category representing the work they were engaged in at the time. The categories used are shown in Figure J-2.

*United States Catholic Conference
Department of Education
1312 Massachusetts Ave.
Washington, D.C. 20005

**Other methods of central signaling involve using the central intercom system, the telephone system, or a central bell system.

FIGURE J-2

CATEGORIES AND RESULTS OF THE CARROLL AND TAYLOR STUDY

PROPORTION OF TIME SPENT IN VARIOUS WORK ACTIVITIES AS DETERMINED BY ESTIMATES AND BY WORK SAMPLING

Work activity	Job time proportions as determined by work sampling		Job time proportions as determined by estimates	Differences in average time allocation
	n	%	%	%
Conversation	246	10.3	7.5	2.8
Filing	202	8.5	10.8	2.3
Idle and Personal	169	7.1	2.4	4.7
Machine operation	155	6.5	12.4	5.9
Mail handling	11	.5	.8	.3
Telephone	108	4.6	7.9	3.3
Typing	179	7.5	6.3	1.2
Walking	89	3.7	5.0	1.3
Writing, research and review[a]	1074	45.1	46.8	1.7
Other	75	3.2	0.0	3.2
Unknown	72	3.0	0.0	3.0
Totals	2380	100.0	100.0	

[Carroll and Taylor, 1969: 165]

This procedure has a disadvantage of some built in dependence between observations. If the time hit during a work break and work breaks were taken together, then all 16 observations would end up in this category. The significance of this problem will decrease as the number of observations increase. The results of the study are shown in Figure J-2.

Carroll and Taylor indicated that "although the differences between the two methods as a whole were statistically significant, the table indicates that the differences between the time proportions obtained by the two different methods were quite small." [Carroll and Taylor, 1969 p. 362] They concluded that the self observation central signalling (SOCS) method could serve as a replacement for traditional work sampling procedures in many situations because the differences were small. The main advantages of the method are (1) Simple to use, (2) inexpensive, (3) ability to study the purpose or subject of the activity rather than the activity itself. Carroll and Taylor cited that the distinct disadvantage of the traditional work sampling approach lies in the necessity of using an outside observer and his reliance upon visual inspection in the classification of work activities.

> This is especially true when studying higher level jobs where the proportion of time spent in overt activities like talking and reading and walking is of little or no significance at all in gaining an understanding of what is done on that job. [Carroll and Taylor, 1969, p. 360]

<u>WHITE STUDY</u>: John C. White, Staff Assistant, Headquarters Engineering, Westinghouse Electric Corporation did a study with engineers using a low power radio transmitter. Each engineer had a set of 12 cards for

each day that were pre-numbered. The sound of the tone on the small pocket receiver that each engineer carried was his cue to record his activity. A verbal message followed indicating the number of the card to record his activity.on. The cards used were mark sense tabulating cards to facilitate easy processing of the data.* Ten engineers were studied over ten days using 12 observations per day for a total of 1200 observations. The activities and results are shown in Figure J-3.

The following conclusions were cited in White's study. [White, 1968: xxi]

1. The self reporting bias introduced when the participant initiates activity data, it appears is partially offset by the error introduced in routine studies when the observer used his judgment to classify activities.

2. Self reporting bias can be reduced by a collection system that provides anonymity to the participant.

3. The radio signaling system used in the study had distinct limitations. Distance and shielding problems preclude using this system when the movement of the participants becomes extensive.

4. The development of a convenient reliable, low cost signaling system that can provide broad coverage appears to be one of the key restrictions to the use of the Self Reporting Mode of work sampling.

5. The cost of administering this technique is low, and it entails a minimum of interference to normal work routine.

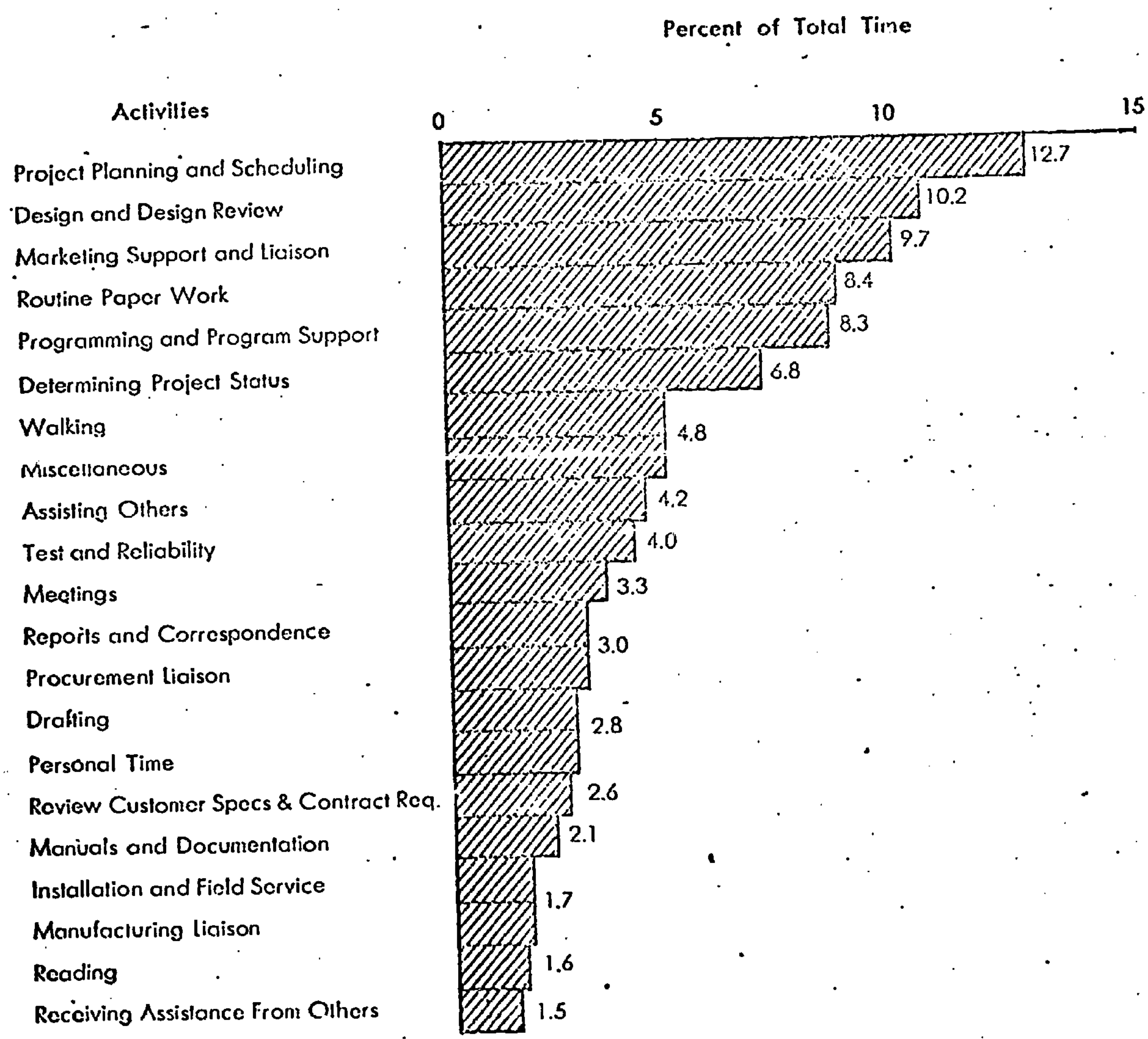
6. It must be used periodically, in a statistically sound manner to provide valid meaningful information.

7. Further experimentation with this technique will be required to establish its significance as an engineering management tool.

*"Porta Punch" cards can also be used as a convenient means of collecting the data [Frank, 1970: 27].

FIGURE J-3

CATEGORIES AND RESULTS OF THE WHITE STUDY



[White, 1968: xx]

HINRICHS STUDY: This study was conducted among technical employees of a large research and engineering company. A total of 11, 191 work sample observations were made on 232 technical employees. The study was originated to (1) determine the extent and manner of employee communication in a large technical organization; and (2) to determine possible relationships between selected communication dimensions and employee effectiveness. [Esso Research and Engineering Company, 1959] The study went for eleven consecutive days. The observation times were developed by an IBM 650 program and printed on forms. Each participant in the study was given 5 forms per day with the time on them. Alarm wrist watches were used to signal the points. The participant set the alarm for the first point and went ahead with his activity. When the alarm rang, he recorded his activity and set the alarm for the next time indicated by the next card.

The communications dimension studied across the organization was as follows:

1. Participant Characteristics of the Communication Event
    a. Who started this communication? Who caused the communication to occur? Who called the meeting?
    b. Who originated the idea with which the communication deals?
    c. How many people are involved in the communication event?
    d. Whether or not the subject of the communication requires action by someone.
    e. Direction or Level of Communication
        (1) Level of the participants
        (2) Level to which the written matter is directed
        (3) Level of the writer or writers
        (4) To what organization do other participants belong?
        (5) To what organization do the other people who prepared the reading material belong?

2. <u>What media of communicating is used and how much time is spent?</u>
   a. Communicating
      (1) Writing
      (2) Listening - Speaking
      (3) Reading
   b. Not-Communicating

3. <u>The function and importance of communication</u>
   a. What is the major function of the communication?
   b. What is the importance of the communication?

4. <u>What is the subject of the communication?</u>
   a. Technical subject
   b. Non-technical subject [Hinrich, 1959]

<u>BARRON AND HESS STUDIES</u>: The most recent studies using the self observational techniques have been done with medical doctors to study physician activity and communications behavior. A study was made by F. Hutton Barron, School of Business, University of Kansas, and Sidney W. Hess, Management Science Center, University of Pennsylvania with 229 physicians. A total of 5400 observations were taken over the 229 physicians. Each physician carried a random alarm mechanism (RAM) for a period of one week. It was through Sidney Hess that the author was introduced to the device used in this thesis. The doctor carried the device for the entire day, but did not record start and stop of times for the day. The average time per day sampled was estimated by the formula

$$n/2 = N/t$$

where

n = Number of buzzes in two hour intervals where they felt all units were operating

2 = 2 Hours

N = Total number of buzzes

t = Estimated time spent

Barron indicated their estimate of "t" was consistently 14 hour per day. He indicated that they wanted about 8 observations per day and got only about 4. This was due to a problem of device realiabilty and also to missed points. (Doctors forgetting to use the device or not hearing it)

Figure J-4 shows a breakdown of the doctors studied and the number of observations obtained per doctor. Figure J-5 shows an example of the data card filled out each time the RAM unit buzzed.

The data was analyzed as to where and how the doctor spent his time. This was done by different classes of doctors as well as by type of activity.

FIGURE J-4

BARRON AND HESS STUDY

Number of Doctors, Observations, Observations Per Doctor

Category	Doctors	Observations	OBS/MD
Urban GP pre 1913	15	473	31.5
Rural GP pre 1913	14	398	28.4
Urban GP 1913-1930	55	1203	21.9
Rural GP 1913-1930	44	984	22.4
Urban GP post 1930	25	582	23.3
Rural GP post 1930	10	192	19.2
Urban Certified Internist	14	318	22.7
Rural Certified Internist	16	349	21.8
Urban Other Internist	18	450	25.0
Rural Other Internist	18	412	22.9

[Barron and Hess, 1970: A-1]

FIGURE J-5

BARRON AND HESS STUDY

DATA CARD

(Fill out one card each time
the alarm sounds)

Date__________ Time__________ a.m.
p.m.

A. Where are you at the moment?

___In my office
___At home
___In hospital
(not in library)
___In transit
___At patient's home
___In medical library
___Other (specifiy)__________

B. What are you doing?

___Eating
___Recreation (theatre, sports, etc.)
___Writing
What?__________
___Listening to radio
___Watching TV
___Reading (professional or non-professional)
except advertising mail
Name of Book or Periodical__________
Date of Issue__________
___Advertising
___Non-Advertising
Page?__________
___Reading advertising mail
___Seeing patient
___Conversing with colleague
___Conversing with detailman
___Conversing with paramedical personnel
___In medical meeting. Identify below
___Other (Specify)__________

C. If engaged in a professional activity, were you attempting to gain information about a specific problem?
___Yes
___No

[Barron and Hess, 1970: A-3]

APPENDIX K

CAMPUS OUTPUTS

PROJECT PRIME PARAMETERS

SCHOOL OF BUSINESS ADMINISTRAT ON PRIME FACULTY PARAMETERS

COST CENTER	UNIV. OF MINN--SCH OF BUSINESS	COST CENTER REPORT 2.3
LEVEL NODE		SESSION 1969/70
1 DEPARTMENT 5 ACCOUNTING		SIMULATION PERIOD 1
AFFILIATED WITH 3 INSTRUCTION		

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	518	33	17,000	144	119
LECTURE1	FULL-TIME	382	56	21,000	106	202
LECTURE3	FULL-TIME	17	56	1,000	17	56
LECTURE4	FULL-TIME	28	56	2,000	28	56
LECTURE5	FULL-TIME	13	56	1,000	13	56
TOTAL DIRECT ACTIVITY LOAD		958	[illegible]4	42,000	308	137
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	167	56	9,000		
RESEARCH	GENERAL	140	56	8,000		
PUBLIC SERVICE	GENERAL	91	56	5,000		
PROF DEVELOP	GENERAL	41	56	2,000		
STUDENT SUPPORT	GENERAL	18	56	1,000		
TOTAL NON-ACTIVITY LOAD		457		25,000		
EXCESS STAFFING UNITS		115		6,000		
TOTAL FOR ALL STAFF LOADS		1530		74,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

COST CENTER LEVEL	NODE
1 DEPARTMENT	6 FINANCE/INS
AFFILIATED WITH	3 INSTRUCTION

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	50	27	1,000	14	97
LECTURE1	FULL-TIME	324	54	17,000	90	194
LECTURE2	FULL-TIME	22	54	1,000	6	194
LECTURE3	FULL-TIME	8	54	0,000	8	54
LECTURE4	FULL-TIME	33	54	2,000	33	54
LECTURE5	FULL-TIME	8	54	0,000	8	54
TOTAL DIRECT ACTIVITY LOAD		445	48	21,000	159	133
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	187	54	10,000		
RESEARCH	GENERAL	160	54	9,000		
PUBLIC SERVICE	GENERAL	104	54	6,000		
PROF DEVELOP	GENERAL	46	54	2,000		
STUDENT SUPPORT	GENERAL	21	54	1,000		
TOTAL NON-ACTIVITY LOAD		518		28,000		
EXCESS STAFFING UNITS		99		5,000		
TOTAL FOR ALL STAFF LOADS		1062		56,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

COST CENTER
LEVEL
1 DEPARTMENT
AFFILIATED WITH

NODE
7 IND'L RELATIONS
3 INSTRUCTION

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	65	27	2,000	18	97
LECTURE1	FULL-TIME	223	56	12,000	62	202
LECTURE2	FULL-TIME	43	56	2,000	12	202
LECTURE3	FULL-TIME	8	56	0,000	8	56
LECTURE4	FULL-TIME	56	56	3,000	56	56
LECTURE5	FULL-TIME	5	56	0,000	5	56
TOTAL DIRECT ACTIVITY LOAD		400	48	19,000	161	119
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	246	56	14,000		
RESEARCH	GENERAL	220	56	12,000		
PUBLIC SERVICE	GENERAL	143	56	8,000		
PROF DEVELOP	GENERAL	64	56	4,000		
STUDENT SUPPORT	GENERAL	29	56	2,000		
TOTAL NON-ACTIVITY LOAD		702		40,000		
EXCESS STAFFING UNITS		59		3,000		
TOTAL FOR ALL STAFF LOADS		1161		64,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

COST CENTER LEVEL	NODE
1 DEPARTMENT	8 MGMT SCIENCE
AFFILIATED WITH	3 INSTRUCTION

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	410	32	13,000	114	115
LECTURE1	FULL-TIME	79	59	5,000	22	212
LECTURE2	FULL-TIME	43	59	3,000	12	212
LECTURE3	FULL-TIME	12	59	1,000	12	59
LECTURE4	FULL-TIME	36	59	2,000	36	59
LECTURE5	FULL-TIME	8	59	0,000	8	59
TOTAL DIRECT ACTIVITY LOAD		588	41	24,000	204	118
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	246	59	15,000		
RESEARCH	GENERAL	220	59	13,000		
PUBLIC SERVICE	GENERAL	143	59	8,000		
PROF DEVELOP	GENERAL	64	59	4,000		
STUDENT SUPPORT	GENERAL	29	59	2,000		
TOTAL NON-ACTIVITY LOAD		702		42,000		
EXCESS STAFFING UNITS		231		12,000		
TOTAL FOR ALL STAFF LOADS		1521		79,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

COST CENTER LEVEL	NODE
1 DEPARTMENT	9 MGMT/TRANS
AFFILIATED WITH	3 INSTRUCTION

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	162	33	5,000	45	119
LECTURE1	FULL-TIME	594	56	33,000	165	202
LECTURE2	FULL-TIME	11	56	1,000	3	202
LECTURE3	FULL-TIME	8	56	0,000	8	56
LECTURE4	FULL-TIME	92	56	5,000	92	56
LECTURE5	FULL-TIME	8	56	0,000	8	56
TOTAL DIRECT ACTIVITY LOAD		875	51	44,000	321	138
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	226	56	13,000		
RESEARCH	GENERAL	200	56	11,000		
PUBLIC SERVICE	GENERAL	130	56	7,000		
PROF DEVELOP	GENERAL	58	55	3,000		
STUDENT SUPPORT	GENERAL	26	55	1,000		
TOTAL NON-ACTIVITY LOAD		640		35,000		
EXCESS STAFFING UNITS		51		3,000		
TOTAL FOR ALL STAFF LOADS		1566		85,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

COST CENTER
LEVEL NODE
1 DEPARTMENT 10 MARKETING/BLAW
AFFILIATED WITH 3 INSTRUCTION

UNIV. OF MINN.--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	86	27	2,000	24	97
LECTURE1	FULL-TIME	274	45	12,000	76	162
LECTURE2	FULL-TIME	58	45	3,000	16	162
LECTURE3	FULL-TIME	2	45	0,000	2	45
LECTURE4	FULL-TIME	38	45	2,000	38	45
LECTURE5	FULL-TIME	2	45	0,000	2	45
TOTAL DIRECT ACTIVITY LOAD		460	42	19,000	158	121
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	324	45	15,000		
RESEARCH	GENERAL	300	45	14,000		
PUBLIC SERVICE	GENERAL	195	45	9,000		
PROF DEVELOP	GENERAL	87	45	4,000		
STUDENT SUPPORT	GENERAL	39	45	2,000		
TOTAL NON-ACTIVITY LOAD		945		44,000		
EXCESS STAFFING UNITS		188		8,000		
TOTAL FOR ALL STAFF LOADS		1593		71,000		

BIR PARAMETERS

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

COST CENTER LEVEL	NODE
1 DEPARTMENT	5 ACCOUNTING
AFFILIATED WITH	3 INSTRUCTION

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	518	33	17,000	144	119
LECTURE1	FULL-TIME	382	58	22,000	106	209
LECTURE3	FULL-TIME	17	58	1,000	17	58
LECTURE4	FULL-TIME	28	58	2,000	28	58
LECTURE5	FULL-TIME	13	58	1,000	13	58
TOTAL DIRECT ACTIVITY LOAD		958	45	43,000	308	140
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	167	58	10,000		
RESEARCH	GENERAL	139	58	8,000		
PUBLIC SERVICE	GENERAL	62	58	4,000		
PROF DEVELOP	GENERAL	18	58	1,000		
TOTAL NON-ACTIVITY LOAD		386		23,000		
EXCESS STAFFING UNITS		87		4,000		
TOTAL FOR ALL STAFF LOADS		1431		70,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER	NODE
LEVEL	
1 DEPARTMENT	6 FINANCE/INS
AFFILIATED WITH	3 INSTRUCTION

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	50	27	1,000	14	97
LECTURE1	FULL-TIME	324	56	18,000	90	202
LECTURE2	FULL-TIME	22	56	1,000	6	202
LECTURE3	FULL-TIME	8	56	0,000	8	56
LECTURE4	FULL-TIME	33	56	2,000	33	56
LECTURE5	FULL-TIME	8	56	0,000	8	56
TOTAL DIRECT ACTIVITY LOAD		445	50	22,000	159	139
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	187	56	10,000		
RESEARCH	GENERAL	158	56	9,000		
PUBLIC SERVICE	GENERAL	70	56	4,000		
PROF DEVELOP	GENERAL	21	56	1,000		
TOTAL NON-ACTIVITY LOAD		436		24,000		
EXCESS STAFFING UNITS		82		4,000		
TOTAL FOR ALL STAFF LOADS		963		52,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

COST CENTER	
LEVEL	NODE
1 DEPARTMENT	7 IND#L RELATIONS
AFFILIATED WITH	3 INSTRUCTION

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	65	27	2,000	18	97
LECTURE1	FULL-TIME	223	56	12,000	62	202
LECTURE2	FULL-TIME	43	56	2,000	12	202
LECTURE3	FULL-TIME	8	56	0,000	8	56
LECTURE4	FULL-TIME	54	56	3,000	56	56
LECTURE5	FULL-TIME	5	56	0,000	5	56
TOTAL DIRECT ACTIVITY LOAD		400	48	19,000	161	119
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	246	56	14,000		
RESEARCH	GENERAL	218	56	12,000		
PUBLIC SERVICE	GENERAL	97	56	5,000		
PROF DEVELOP	GENERAL	29	56	2,000		
TOTAL NON-ACTIVITY LOAD		590		33,000		
EXCESS STAFFING UNITS		171		9,000		
TOTAL FOR ALL STAFF LOADS		1161		64,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

COST CENTER
LEVEL
1 DEPARTMENT
AFFILIATED WITH

NODE
8 MGMT SCIENCE
3 INSTRUCTION

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	410	32	13,000	114	115
LECTURE1	FULL-TIME	79	59	5,000	22	212
LECTURE2	FULL-TIME	43	59	3,000	12	212
LECTURE3	FULL-TIME	12	59	1,000	12	59
LECTURE4	FULL-TIME	36	59	2,000	36	59
LECTURE5	FULL-TIME	8	59	0,000	8	59
TOTAL DIRECT ACTIVITY LOAD		588	41	24,000	204	118
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	246	59	15,000		
RESEARCH	GENERAL	218	59	13,000		
PUBLIC SERVICE	GENERAL	97	59	6,000		
PROF DEVELOP	GENERAL	29	59	2,000		
TOTAL NON-ACTIVITY LOAD		590		36,000		
EXCESS STAFFING UNITS		343		17,000		
TOTAL FOR ALL STAFF LOADS		1521		79,000		

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SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

COST CENTER	NODE		
LEVEL		UNIV. OF MINN--SCH OF BUSINESS	COST CENTER REPORT 2.3
1 DEPARTMENT	9 MGMT/TRANS		SESSION 1969/70
AFFILIATED WITH	3 INSTRUCTION		SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	162	33	5,000	45	119
LECTURE1	FULL-TIME	594	58	34,000	165	209
LECTURE2	FULL-TIME	11	58	1,000	3	209
LECTURE3	FULL-TIME	8	58	0,000	8	58
LECTURE4	FULL-TIME	92	58	5,000	92	58
LECTURE5	FULL-TIME	8	58	0,000	8	58
TOTAL DIRECT ACTIVITY LOAD		875	52	45,000	321	141
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	226	58	13,000		
RESEARCH	GENERAL	198	58	11,000		
PUBLIC SERVICE	GENERAL	88	58	5,000		
PROF DEVELOP	GENERAL	26	58	2,000		
TOTAL NON-ACTIVITY LOAD		538		31,000		
EXCESS STAFFING UNITS		54		3,000		
TOTAL FOR ALL STAFF LOADS		1467		81,000		

SCHOOL OF BUSINESS ADMINISTRATION PRIME FACULTY PARAMETERS

UNIV. OF MINN--SCH OF BUSINESS

COST CENTER		
LEVEL	NODE	
1 DEPARTMENT	10 MARKETING/BLAW	
AFFILIATED WITH	3 INSTRUCTION	

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 1

DETAILED BREAKDOWN OF DIRECT ACTIVITY + NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	86	27	2,000	24	97
LECTURE1	FULL-TIME	274	45	12,000	76	162
LECTURE2	FULL-TIME	58	45	3,000	16	162
LECTURE3	FULL-TIME	2	45	0,000	2	45
LECTURE4	FULL-TIME	38	45	2,000	38	45
LECTURE5	FULL-TIME	2	45	0,000	2	45
TOTAL DIRECT ACTIVITY LOAD		460	42	19,000	158	121
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	324	45	15,000		
RESEARCH	GENERAL	297	45	13,000		
PUBLIC SERVICE	GENERAL	132	45	6,000		
PROF DEVELOP	GENERAL	39	45	2,000		
TOTAL NON-ACTIVITY LOAD		792		36,000		
EXCESS STAFFING UNITS		341		15,000		
TOTAL FOR ALL STAFF LOADS		1593		71,000		

APPENDIX L

EXAMPLES OF FACULTY ACTIVITY REPORTS

FORM B

THE UNIVERSITY OF MICHIGAN

ACADEMIC PERSONNEL ACTIVITIES REPORT

OIR COPY

NAME	SOC. SEC. NO.	TERM
LECTURER		FALL TERM, 197_

DEPARTMENT OR AREA	SCHOOL OR COLLEGE	OFFICE(S) - ROOM & BLDG.
MECHANICAL ENGINEERING	ENGINEERING	

IMPORTANT: PLEASE READ ACCOMPANYING INSTRUCTIONS BEFORE WRITING.

RECORD PROFESSIONAL ACTIVITY IN AVERAGE HOURS PER WEEK OR IN PERCENT OF EFFORT, BUT NOT BOTH: IF PERCENT, TOTAL TO 100.

( ) HRS
( ) %

I. INSTRUCTIONAL ACTIVITY — CREDIT INSTRUCTION

DIVISION NAME	DIV. NO.	COURSE NAME	COURSE NO.	CLASS NO.	I.D. NO.	CLASS TYPE	CREDIT HOURS	ENROLLMENT

II. INSTRUCTIONAL ACTIVITY — OTHER THAN CREDIT INSTRUCTION

1. BACHELORS LEVEL DEGREE STUDENTS - ENGINEERING
2. MASTERS LEVEL DEGREE STUDENTS - ENGINEERING
3. PH.D. LEVEL DEGREE STUDENTS - ENGINEERING
4. OTHER STUDENTS - INCLUDING THOSE FROM OTHER SCHOOLS & COLLEGES
5. OTHER INSTRUCTIONAL ACTIVITY

III. RESEARCH AND CREATIVE ACTIVITY

1. SPONSORED
2. DEPARTMENTAL

IV. SERVICE ACTIVITY

(PLEASE LIST)

V. ADMINISTRATIVE ACTIVITY

(PLEASE LIST)

VI. PROFESSIONAL DEVELOPMENT (KEEPING UP WITH THE FIELD)

DO NOT USE THIS SPACE

TOTAL

TO BE COMPLETED BY:
OCTOBER 30th - FALL SEMESTER
MARCH 15th - SPRING SEMESTER

RENSSELAER POLYTECHNIC INSTITUTE
FACULTY ACTIVITIES REPORT
(See Instructions on Reverse)

NAME (last first) ____________ Title

DEPARTMENT ____________

SEMESTER ____________ Year

COURSE			ACTIVITY							PHYSICAL FACILITY			
1. Course Number	2. Course Credit Hours	3. Course Contact Hours (Actual)	4. Sub-Div. of Course	5. Credit Hours Taught	6. Contact Hours Taught	7. Number of Students	8. Student Credit Hours	9. Student Contact Hours	10. Freq. of Course	11. Building	12. Room Number	13. Time	14. Days
			Lec										
			R-D										
			SS										
			Des										
			Lab										
			Lec										
			R-D										
			SS										
			Des										
			Lab										

IF THE FOLLOWING LINES ARE USED FOR ADDITIONAL COURSES, WRITE IN COLUMN 4 THE SUBDIVISION OF COURSE - LEC. R-D SS. Etc.

NOTES:

15a. Professional Activities

15b. List in this area: Institute Activities such as, Committees, Course Development, Curriculum Development, Student Consultation, Special Assignments.

The following items are also to be completed:

16. If you are not employed full-time, give percentage of full-time employment ____________ %

17. Give percentage of Time Allocation in appropriate column below:

	Full Time	Part-time
Instructional Undergraduate	%	%
Instructional Graduate	%	%
Sponsored Research	%	%
	100 %	100 %

18. If you also teach in Evening Division, provide course numbers. ________ ________. Are these courses part of your regular work load? ____________

(Signature) STAFF MEMBER

(Signature) DEPARTMENT HEAD

Copy To (See Special Instructions on Reverse for Routing)
Goldenrod To Department Head
Pink To Proper Dean
Yellow To Personnel File
White To Institutional Research

BIBLIOGRAPHY

BIBLIOGRAPHY

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